RAILROAD GAZETTE

A Journal of Transportation, Engineering and Railroad News.

QUARTO VOL. II.—NO. 12. Fourteenth Year. | CHICAGO, SATURDAY, DECEMBER 17, 1870. | $3.00 per Annum, until 1871. $4 per Annum, thereafter.

PUBLICATION OFFICE, 99 & 101 WASHINGTON STREET, CHICAGO.

INDEX TO RAILROAD ADVERTISEMENTS.

	PAGE		PAGE
Chicago, R. I. & Pacific	283	Chicago, Alton & St. Louis	284
Kansas City, St. Joseph & Council Bluffs	285	Chi. Burlington & Quincy	284
Kansas Pacific	283	North Missouri	284
Chicago & Northwestern	283	Pacific of Missouri	284
Pan-Handle	285	Pennsylvania & Ft. Wayne	285
Western Union	283	Erie Railway	285
Milwaukee & St. Paul	283	Illinois Central	286
Hannibal & St. Joseph	284	Michigan Southern	286
		Michigan Central	287

For Table of Contents, see Page 274.

THE ENGLEWOOD SHOPS OF THE CHICAGO, ROCK ISLAND & PACIFIC RAILROAD.

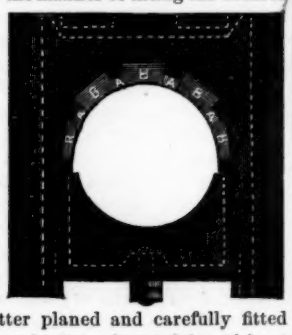
Last week we gave some description of the locomotives which Mr. Twombley, the Master Mechanic of this road is building; this week we give a plan of the shops, engine house, etc. At the time they were planned the ground was unoccupied, so that there was nothing in the way to hinder the engineer, or prevent the adoption of the most convenient arrangement of buildings possible. Mr. Johnson, the Chief Engineer of the Rock Island road, has evidently appreciated this liberty, and has built probably the most convenient shops in the West.

Referring to the plan, *E, E*, is the engine house, which is 278 ft. in diameter and has 41 stalls for locomoiives. The house is 60 ft. wide, measuring from the inner to the outer wall, with a 60 ft. turn-table in the centre. The stalls and smoke pipes are arranged so that the engines are run in head first. As nearly all the work done to a locomotive is on the engine itself—the tender usually requiring very little repair—this position is the most convenient, as it allows more room between the tracks, where the work is to be done. There is also more and better light from the outside windows than it is possible to get from the doors.

From the round house a track leads to the transfer table, by which an engine can be carried to any one of the stalls in the machine shop, *A, A*. Each stall has a pit, *a, a, a*, for convenience in making repairs. The roof of the machine shop is supported by two rows of columns, which divide it into three sections; the one occupied by the pits for the repair of engines; that on the other side by the machine tools; while the middle one is left open for the transfer of wheels, axles, etc., from one part of the shop to the other.

The machine tools are of the very best description, and with the latest improvements. The majority of them were built by Bement & Dougherty, and some by Wm. Sellers & Co., and other makers. The tool-room and store-room are in the two right-hand rooms marked *o*. All the tools are kept in the best condition and are in the care of a man who has special charge of them. Every tool taken out by any of the men is charged on a slate, and the charges rubbed out when it is returned. We should think there might sometimes be difficulty in this system, from the errors of the person in charge of the room: for example, if one of the men should take out a tool and it should be charged against him, and on its return some charge against another man should be rubbed out by mistake, evidently there would be two errors, *i. e.*, a credit to one and a charge to another. A better system would seem to be one in which checks or receipts are used, so that when a tool is taken away, some evidence is left of that fact, and when it is returned the person would receive back his receipt or check and have evidence himself of having done so.

In several previous articles on other shops, we have made some reference to the manner of fitting the brasses into driving boxes. Mr. Twombley showed us what his practice is, in this respect, and has since sent us a tracing, which we have had engraved. The brasses, *B, B*, are made in separate pieces, and are dovetailed into the housing. The seats for the brasses are accurately slotted out, and the latter planed and carefully fitted and driven in. They are both made straight, without any taper. The spaces between *A, A* are then filled with Babbitt's metal, and the whole bored out. The advantage claimed for this arrangement is, that in case the side brasses wear, they can easily be "shimmed" up and the box rebored.



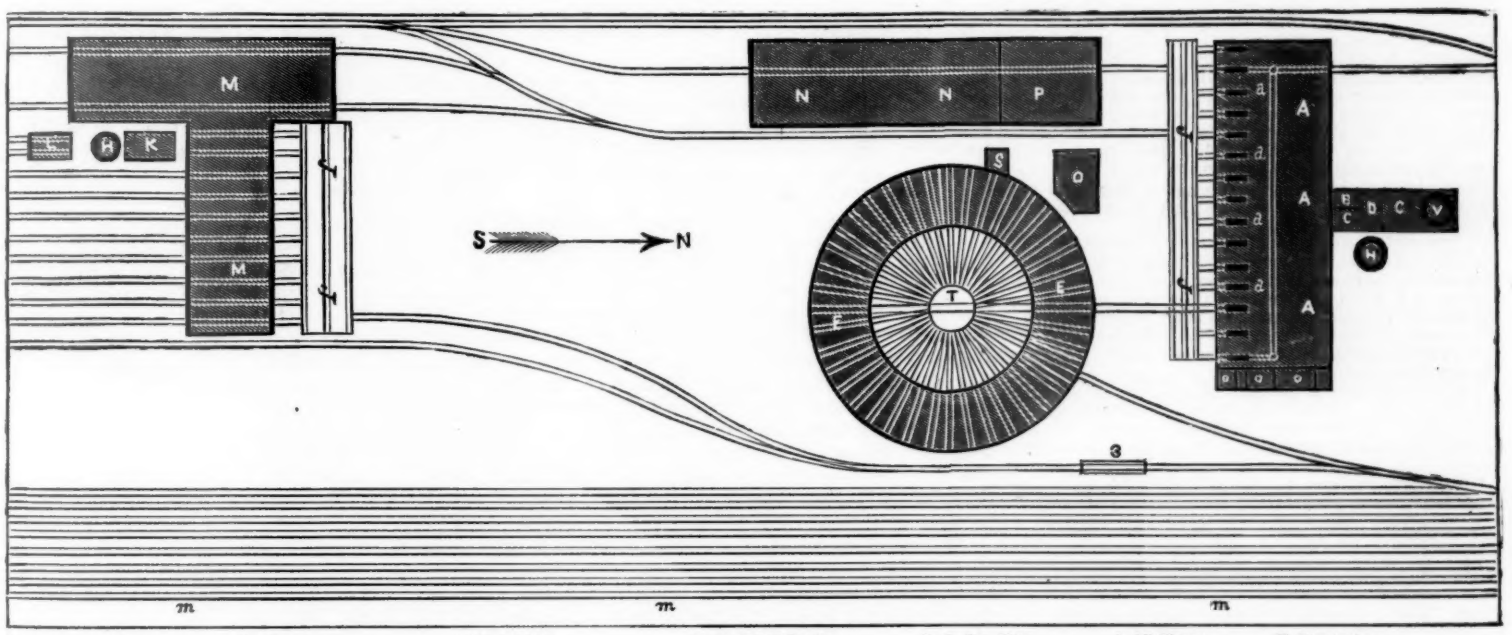
The stationary engine room *B*, boiler room *D*, and wash-room *C*, are adjoining the machine shop. The latter has hot and cold water, and a cast iron sink running around two sides of the room, which is heated by steam. Arrangements were made for water closets in this room, but the want of sewerage has prevented the completion of this part of the plan.

The boiler shop *P* is 80x92 feet, and arranged for the transfer of boilers, either from or to the machine shop. In describing the boilers made by different master mechanics, we have been particular to state the manner in which the rivets are spaced. At some future time we will make some comparison of the different practices. As stated in the specifications, all the horizontal seams of boilers made by Mr. Twombley are double riveted. The rivets are ⅝ in. in diameter, spaced zig-zig, 1¾ in. from centre to centre in the same row, and the rows are 1¾ in. apart.

The blacksmith shop is 80x252 feet and is adjoining the boiler shop. It has a scrap furnace, three steam hammers, and a large punching and shearing machine. The latter was built by Elmes & Son, of Chicago. It is run by an independent engine, with a cylinder 8 in. diameter and 10 in. stroke. The motion is imparted to the punch and shear by two bell cranks, one for each. We saw some bars of iron 4½x2 in. which were sheared off cold, and were told that it will punch a 2-in. hole through 1½-inch iron. The blacksmith shop has a furnace for working up scrap, which is done under a 1,250 lb. Watt helve hammer. Besides this one there are two other steam hammers, one built by Bement & Dougherty, the other by Sellers. There is also a bolt machine which was new to the writer at work adjoining the blacksmith shop. It was built by Lewis & Oliver, of Chicago, we believe, although we are not sure of their address. This machine is said to make from one to three thousand ¾ or ⅞ in. bolts in a day.

Adjoining the round-house Mr. Twombley is building a sand house. We saw the drawings of the arrangements for drying and sifting the sand, which are the simplest we have seen. They consist first of a sheet-iron pan 10ft. 2in. by 5ft. 3in. and 7in. deep. In the bottom of this is a coil of wrought-iron steam pipe formed of two 12 branch Ts. with the branches of 1 in. pipe attached. The bottom of the pan is to have a door through which the sand can be emptied upon a sieve which runs on rollers below. The sand can be shoveled from a car run on the track immediately behind the sand house into the drying pan, and then from under

Wentworth Avenue.



A, A. Machine Shop. *a, a, a.* Pits. *B.* Stationary Engine Room. *C.* Wash Room. *D.* Boiler Room. *E, E.* Locomotive House. *I.* Turn-Table. *M, M.* Car Shop. *K.* Stationary Engine House. *H, H.* Water Tanks. *L.* Dry House. *N, N.* Blacksmith Shop. *P.* Boiler Shop. *J, J.* Transfer Table. *S.* Sand House. *O.* Oil House. *s.* Track Scale. *G.* Gas Room. *V.* Gasometer. *o, o, o.* Offices and Store Room. *m, m, m.* Main Track.

PLAN OF THE SHOPS OF THE CHICAGO, ROCK ISLAND & PACIFIC RAILROAD, NEAR CHICAGO.—Scale, 1-16 in.=10 ft.

the sieve, taken into the engine house, and then distributed to the engines. All the work of drying the sand and distributing it to the engines is done by one man.

The oil house has two stories and is entirely fireproof. In the lower room are six cylindrical iron tanks, each of which will hold 2,000 gallons. They all have glass tubes on the outside—similar to a glass steam gauge, only longer—to show the height of the oil in the tank. The oil in the barrels is hoisted into the second story, and there emptied into the tanks and distributed for use from the tanks below.

The gas for illuminating the shops is manufactured in the room marked "G" on the plan. The apparatus used is the Petrolio-Calcium Gas Machine, patented by J. H. Connelly, of Wheeling, Va. The gas is made from the residium of coal oil refineries, and costs about $1.50 per thousand feet. The whole apparatus is attended to by the engineer and fireman of the stationary engine. The air for the gas is supplied from the fan used for the shops.

Mr. Twombley employs in his department about 270 men, exclusive of engineers and firemen. The car shops are not under his jurisdiction, and the men employed there are not included in the above figures. He has given us the following statement, showing the additions which have been made to the motive power and the repairs done on locomotives during the year ending March 31st, 1870:

"At the beginning of the year there were owned and employed by this company 107 locomotives. Two locomotives have been built new, throughout, at the Chicago shops, being first-class, heavy coal-burning engines. Twenty-four locomotives have been bought and put in service during the year, briefly described as follows:

20 built by Grant Locomotive Works.
3 built by Rogers Locomotive and Machine Co.
1 built by Taunton Locomotive Works.

"One of the Grant engines, No. 109, known as the 'America,' is a first-class, heavy coal-burning passenger engine, size of drivers 66 in., diameter of cylinders 16 in.x22 in. stroke. Fifteen of the Grant engines are first-class, heavy coal-burning freight engines, all of one size. Drivers are 61 in. in diameter, cylinders 16x24 in. Four of the Grant engines are first-class, heavy coal-burning tank engines for switching, drivers 49 in., diameter cylinders 14x22 in.

"The Taunton engine is a first-class, heavy coal-burning passenger engine, drivers 68 in. in. diameter, cylinders 16x24 in. stroke. The three Roger engines are first-class, heavy coal-burning passenger engines, with 66 in. drivers and 16x24 in. cylinders.

"Two engines are now in course of construction at the Chicago shops, both being nearly finished. Twenty-four engines have been rebuilt and furnished with new boilers and fire-boxes. Fifty-six engines have been thoroughly overhauled and generally repaired in machine shops. Twenty-seven engines have been temporarily out of service and have received slight repairs in the round house.

"It is impossible in this limited space to mention in detail the general or light repairs which have been done on engines. Below may be found account of the leading articles of new work which have been supplied.

"Fourteen engines not including those bought nor those built have been furnished with complete sets of new steel tires. Nine tenders complete have been made and furnished to engines, and twenty-three under frames complete, thirty locomotive cabs, fifty-eight pilots and eighty-three smoke-stacks have been made. Fifty-two new head lights have been furnished to engines. Ninety-six new crank-pins have been made and disposed of as follows:—Nineteen engines have been furnished with four each, three engines with two each, and fourteen are in store. Eleven new driving axles have been put in. Fifteen new cylinders have been made.

"Two engines besides the twenty-five that have had new boilers have been furnished with steel fire-boxes. Thirty-one engines have had their cross heads fitted up with Harden's patent glass bearings. Twenty three engines have been furnished with patent safety valves. One hundred and ten pairs of truck wheels and axles have been fitted up and put under engines. One hundred and seventy-six new tender axles have been fitted up and put under.

"Forty-two engines have been re-painted and varnished throughout.

"The following miscellaneous articles have also been manufactured in the Master Mechanic's department—

"Two heavy snow plows have been built from drawings and plans furnished by the Master Mechanic.

"Three 'locomotive' boilers have been rebuilt and fitted up as follows:—One connected with steam pipes and fittings and placed in round house at the new shops for heating; one connected with steam pump and fittings and sent to Davenport for water supply; one sent to Stuart for supplying steam for stationary engine in machine shop.

"One ten-horse power engine with boiler has been built (new throughout) and sent to Des Moines for machine shop. One ten-horse power engine with boiler has been thoroughly repaired and fitted up for a new pile-driver, which has been built at car shop.

"The following named tools have been made and put in operation at the Chicago shops: Two 4 ft. radial drills; one flue-cleaning machine; one traverse crane, running the whole length of the machine shop; one turning lathe for wood; one cutting-off saw and table; one splitting saw and table, and one scroll saw and table.

"The following new machinery has been added to the Chicago shops:

One axle cutting-off lathe, built by Bement and Dougherty.
One lathe 3x16 feet, built by Ames Manufacturing Co.
One lathe 4x16 feet, built by Ames Manufacturing Co.
Two lathes 5x20 feet, built by Ames Manufacturing Co.
One 8-inch shaping machine, built by Bement & Dougherty.
One 8-inch shaping machine, built by N. Y. Steam Eng. Co.
One wheel-boring machine, built by Bement & Dougherty.
One bolt-cutting machine, built by W. Stafford.
One steam punch and shears, built by Elmes & Son.
One steam hammer, built by James Watt.
One boring machine, built by J. A. Fay & Co"

Mr. Twombley has recently changed his system of paying engineers and firemen. They were formerly, as we believe on most roads they are now, paid by the day, and an allowance of time is made for delays from accidents or other causes. On the Rock Island road they are now paid by the mile, and are divided into four classes. The first class are those who have run four years; the second those who have run three years; the third those who have run two years, and the fourth those who have run only one year. Some discretion is used in promoting men from one class to another, and allowance made for previous conduct, intelligence and efficiency. We are disposed to believe that the consideration of merit should be made a more important element in the advancement of men from one class to another. It would be more just and a greater incentive to good conduct to the men. That there are great practical difficulties in the way of applying the principle of advancement for merit we are well aware, but the subject is important enough for careful consideration, which is all we desire to suggest now.

The number of miles which the engines make is kept from the service sheet, which is daily posted up in the round house. These sheets are used instead of the customary blackboard with names written with chalk. The headings of the sheet are: number of engine; time of starting; kind of service; destination; name of engineer; and name of fireman. These sheets are preserved, and the mileage of the men made out from them.

Mr. Twombley also showed us a book in which he keeps an account of the length of service of truck wheels, which are put under engines and tenders. The following headings will explain its scope: Date when changed; engine truck, 1st, 2d pair; tender, 1st, 2d, 3d, 4th pair; size of wheel; new or second-hand axles put under; why removed; maker's name of wheels put under; maker's name of wheels removed; remarks.

This seems to supply all the necessary information and to furnish a system of keeping an account of a matter which usually all a muddle.

The car shops are under the charge of Mr. Fogg, and are a separate department from that over which Mr. Twombley presides. There is very little new work in progress here, and, in fact, economy seems to be the order of the day in all the shops. The men are working only eight hours, and there seems to be a dullness everywhere which, it is hoped, the spring business will dissipate. At some future time we expect to give some fuller account of the car department of the Rock Island road. Time and space prevent in this issue.

—Col. Clark W. Thompson, the General Manager of the Southern Minnesota Railroad, owns 16,000 acres of land in Minnesota in the centre of which is the town of Wells, 155 miles west of La Crosse on the Southern Minnesota Railroad. Of this, 12,000 acres in the form of a square, form the township of Clark. A belt around this tract 200 feet wide is planned and will be planted with forest trees, many of them nut-bearing. A correspondent of the Chicago *Evening Post* describes the manner in which the land is to be improved:

"The towuship of Clark has been laid out into farms each containing one quarter section, or 160 acres. Upon each quarter section a brick house, two stories high, 26x28 feet, with a cellar under each is to be constructed. Twenty of these farm houses are already erected, and twenty more will be built next year. These buildings appear to be located near the section lines, in such a way that on opposite sides of the line there are rows of houses with a broad avenue between, giving to the occupants all the advantages of near neighborhood to each other. There will, in two or three years, thus be not less than 64 substantial dwellings on this large farm, uniform in size, appearance and arrangement."

These farms are to be let under certain specifications as to the crops to be cultivated, and a share of the products will be taken for rent.

—The London *Daily News* says: "Railway travel, with all its drawbacks and accidents, is the safest system of traveling ever organized. The persons injured only amount to one in half a million of travelers. Is there any other method of traveling by which any such safety was ever attained, or even approached? It is actually safer to go by railway than to walk."

Contributions.

THE WARMING AND VENTILATION OF CARS.

BY WM. S. HUNTINGTON.

The warming and ventilation of passenger cars is now receiving the attention of railroad men, and it would seem that a great deal of money is being expended by various railroad companies with a view to ascertain by experiment what is the most efficient contrivance for that purpose. This is a matter of great importance not only to the railway community but to the traveling public: in fact every one is interested in this matter. Many a family has had to mourn the loss of one or more of their number by disease contracted while traveling in overheated and badly ventilated cars. Many times a car is overheated by passengers who have access to the fuel and use it more freely than is necessary. Then those who are seated near the stove are uncomfortably warm while others farther off are shivering with the cold. At other times the fire is allowed to get down so that those near the stove are uncomfortably cold. This is the case on roads where the passengers are expected to regulate the fires. It is the practice on some roads to place a supply of fuel convenient for use, and it is expected that any one will replenish the fires who may feel disposed to do so. On other roads, the train men prefer to attend to the fires themselves and lock up their stoves to prevent fires being tampered with, or (as the conductor said to the passenger who asked him why he had a lock on his stove) "to keep the fire from going out." The plan of locking the stoves is a good one; for then, of course, it will be the duty of some particular person to attend to the fires, and he will be more likely to keep a uniform temperature than could be maintained when the fire is attended to by every one.

But even with the best of management with coal or wood-burning heaters it is difficult to maintain a uniform temperature throughout the entire length of a car, and on this account steam heaters would seem to be preferable. Another serious objection to coal or wood-burners is the almost certain destruction of cars by fire in case of accident. It is unnecessary here to give an account of the horrible results of numerous accidents when the victims were consumed by fire caught from the car heating apparatus. To this loss of life may be added the loss of property which would have been prevented by the use of steam heating apparatus. Several devices for heating by steam have been patented, some of which have been so arranged as to make use of exhaust steam; but this arrangement is attended with many inconveniences. Engineers will generally oppose the plan of heating by running flexible pipes from the smoke-box to the rear of the tender, from whence other pipes pass through the train, partly on account of inconvenience and partly on account of its uncouth appearance. In point of economy, heating by steam seems to have many advantages in its favor, but it is a question whether it can be best accomplished by taking steam direct from the locomotive boiler or by using exhaust steam. It is often necessary to use all the steam for propulsion, and taking it direct from the boiler for heating purposes at such times would be decidedly objectionable. All things considered, it would seem that *any* contrivance for taking steam from the locomotive boiler, either from the exhaust or otherwise, for the purpose in question would be a constant source of annoyance to the engineer and fireman, whose duties and responsibilities should not be increased.

It would not be a costly experiment to fit up a small room in a baggage car with a boiler and other necessary apparatus for generating and conducting steam through the train, the whole to be under the charge of a single person whose other duties would not interfere with its proper supervision. If the boilers were located properly its supervision would not interfere with the ordinary duties of a brakeman. In regard to the economy of such an arrangement, no doubt one-half the fuel required to heat a train in the ordinary way would generate steam sufficient for the purpose. The first cost of a steam heating aparatus would exceed somewhat that of the ordinary coal or wood burning stoves, but it would appear that the saving in fuel together with other advantages to be derived from the use of steam would be sufficient to warrant its use. A fireproof steam room could be fitted up in a baggage car so that in case of a collision or run-off no fire could be communicated to the passenger cars and also so that the car in which the steam room is located would be safe from fire. It should be borne in mind, however, in fitting steam pipes that it is dangerous to have the pipes in contact with wood or other combustible material, or

even very close to it, unless protected in some thorough manner. Fires have sometimes originated in factories and other buildings heated by steam not only where pipes were in actual contact with wood but when two or three inches from it. Flooring will become charred after long continued use of steam pipes beneath it, and pieces of wood which had been within two inches of steam pipes for a considerable length of time been removed have been ignited at very low temperature. Experiments have proved that heating by steam is unsafe unless the pipes in passing through walls or partitions are fitted with non-conducting material; but when pipes and their surroundings are properly fitted this manner of heating may be considered entirely safe. It is certain that a more uniform temperature may be maintained throughout the entire car with steam apparatus than by the use of either wood or coal-burning stoves. But whatever the kind of apparatus used for warming cars no pains should be spared to prevent the cars taking fire in case of accident. Only a moderate shock is required to upset some of the stoves in use or to scatter live coals sufficient to set a car on fire, and instances are by no means few where the only *serious* results of accidents have been the burning of cars together with their living freight. Many an accident has occurred to a passenger train which of itself would not be considered serious, but which termlnated in the horrors of roasting people alive in consequence of fire from stoves. It is therefore from motives of humanity that railroad men should be stimulated to increased exertion in the matter of rendering cars fire-proof under all circumstunces.

In regard to ventilation it may be said that nothing connected with the health and comfort of railroad passengers has taxed the brains of inventors and railroad men to such an extent as the thorough ventilation of cars. Scientific men have also given this matter much attention, and although the results of their labors have been in a measure satisfactory, there yet remains much to be done in this direction. It is hardly to be expected, however, that any system of ventilation will ever be discovered that will be satisfactory to a large class of railroad travelers, whose principal business is traveling and fault-finding. It is no easy matter to admit fresh air to the interior of a passenger coach, and at the same time exclude sparks and cinders. It is not a difficult matter to provide means for the escape of foul air without admitting dust, and it is not that cars are not provided with apparatus for that purpose that gives cause for complaint, but it is improper management of such apparatus as is usually provided.

Recent improvements in spark arresters and smoke-consuming apparatus will somewhat lessen the difficulties heretofore encountered in ventilation. It is reported of a recent trial of a spark-arrester on a road in Massachusetts, that on a trip of forty-five miles, fourteen bushels of sparks, cinders, etc., were collected, or about ten quarts per mile. Although there may be some question about the correctness of this statement, there is no doubt of the advantages to be derived from the use of an efficient spark arrester. When proper ventilation is secured, and warming apparatus brought into use, whereby a uniform temperature may be produced, and maintained throughout the entire car with entire safety from fire in case of accident, the passenger accommodations of American railroads will be very satisfactory, and might be said to be complete.

Painted Connecting Rods.

To the Editor of the Railroad Gazette:

I observe that in your description of the Milwaukee shops, you refer in rather commendatory terms to their practice of painting connecting rods of locomotives, instead of polishing them, between the stub ends. Our practice has been to polish them; first because it looks better, and second because any flaw is much more easily detected on a bright piece of iron than on one which is painted. The cost you have named for finishing is also too high. We grind them on a fast running grind-stone, and the expense is only about $1.50 for each rod, or $6 for a whole locomotive. To plane and file them of course costs more—about $4 each, or $16 per engine. Knowing the humane spirit which you have manifested in advocating everything which will help to save either life or limb, I feel sure in this case you would not recommend a saving of $6 in the cost of a locomotive if thereby greater risk was laid on men who are now so much exposed to danger.

Yours truly, Stub End.

Exactly, if the facts are, as our correspondent says, that a flaw is more easily detected on a polished connecting rod than on a painted one, and if an expenditure of $6 will make any human life more secure, then the subject will admit of no further discussion. But the whole force of the argument turns on the *if*. How are the facts, ye gentlemen who preside over round houses? What think ye of Mr. "Stub End's" assertions. We know that a flaw is often as difficult to detect as it is to find a rabbit under a pile of rails. Do paint and varnish prevent its discovery (we mean the crack not the rabbit), or is it otherwise? Let us hear from you. We have no connecting rods in our office to break, so we are dependent on you for the facts in relation to this question.—Ed. Railroad Gazette.

PROPOSED IMPROVEMENT IN CAR WHEELS AND AXLES.

A Conundrum for Mechanical Correspondents to Solve—Hot Boxes.

The writer has a buggy which has been in his possession about fifteen years, and was an old one when he bought it—one of the old-fashioned "scoop-shovel," low-hang sort; so easy to ride in and so convenient for women and cripples to get in and out of. How old it is he does not know, but it was one of the first iron-axle patent thimble skeins he ever saw. The axles are branded "Wilmington, Del." The pipe boxes in the hub have a little cavity gouged out about the centre to hold oil, and the good condition which the axles and hubs continually keep—the small quantity of oil required to run the vehicle, is something remarkable. This buggy will run fully three months with considerably less than a teaspoonful of castor oil applied to all four of its wheels, or a very few drops on each axle. It has certainly run many thousand miles for its present owner, and the axles are as good as the day they came out of the shop.

Might not this principle be applied to car axles with advantage? The experiment might be tried with very little expense, and there is no patent on the device:

No change is proposed in the present axle and box, though it has always seemed to be a very rough, imperfect piece of mechanism for the immense labor and responsibility imposed on it. Leaving that entirely undisturbed, as at present, and the dimensions of both axle and wheel also, suppose an inch or less were taken off the face of the wheel hub, and a thread cut on the axle to hold a nut large enough to screw on it, and keep the wheel in place. Bore out the hub slightly cone-shaped, half an inch smaller than at present, making the fit on the axle a very close one, and cut a small reservoir for oil in the centre. Turn a journal on the axle for the wheel to revolve on, leaving a small shoulder on the inside to steady the wheel and keep the oil in the hub. Drill an oiling hole half an inch or more in diameter on the inside of the hub in a slanting direction, to communicate with the inner cavity. Attach to it with a screw a very small self-feeder. The wheel would run much more steadily if the hub were cast two inches longer on the inside, or at least six inches in length altogether. Fill the hub and feeder with the best lubricating oil, and that wheel will certainly run for three months without further attention, though all the journals and trucks in a train ought to be carefully examined at the end of every long journey, and as closely inspected by a reliable, competent man, as the wheels of a passenger coach need to be sounded frequently, to be assured of their safety.

The advantages of this plan seem to be many: the excessive friction and motion are diffused and divided by exactly half, and not all concentrated on one journal. In going round a curve, each wheel can move independently, saving all the twist and strain of axles, chiseling and grinding of rails and flattening of wheels, by forcing the outside wheels of each truck to go so much faster and further than the inside ones are going. The objection would probably be the slight additional expense of fitting up, and the duplication of journals to keep up, there being two, where before there was but one. It is believed that a test will prove that the advantages exceed the objections, and that the wear and strain of this important part of railway machinery will be very much obviated, and the power of the locomotive largely economized. The writer has been unable to hear of any trial of this device ever having been been made anywhere, or anything like it. Should any professional master car builder make trial of it, it is to be hoped that he will make his experience public through your columns. At any rate, this is respectfully offered for the friendly criticism of your readers experienced in such matters.

Much of the present difficulty with "hot boxes" might be avoided if more system and greater care were taken in getting up and repairing them. This work ought to be the exclusive duty of one set of men. The grain of the metal in both axles and boxes differs so much and requires such different treatment that great care should always be observed in turning them off. One axle will be very hard and close-grained in texture, and will bear much heavier turning in a lathe, and yet come out smooth and fit for use, while another, with the same set to the tools, will be open-grained and porous, and certain to get hot and cut, and give all sorts of trouble. This last, if not rejected altogether for passenger cars, as it should be, ought to be very slowly turned off, and the natural roughness of the metal carefully smoothed down. The same is true of the brasses in the axle boxes, which require exactly the same treatment, as the metal differs in texture and density.

It is usual, in most shops, for any hand to work at what comes first. The axles are turned off by anybody, who, so long as they come down to the calliper gauge, cares very little how it is done, or whether they are smooth or rough. They are adjusted by anybody—a laborer, or carpenter, or whoever is not engaged on other work, who of course never looks at the manner in which the work is finished, or how it comes together, and who would not find fault or object if he found anything wrong. It is his business to do his own work, not to criticise that of others.

This all wrong, and should be avoided in every well-ordered shop. As the axle is the soul of the machine, without which, in perfect integrity, nothing can go right or safely, the fitting it up ought to be the especial task of one set of careful, reliable, experienced men, who will not allow any work to go out that will not perform its allotted duty the proper and required length of time when on the road.

Any mechanics at all curious in such matters are invited to look at some of their finest polished work through a powerful magnifying glass, if they wish to know why the contact of metals in motion causes so much friction and heat, and cutting. The finest polished razor is seen to be covered with rough hairy fibres and pit-holes, while the keenest edge is a series of rough, serrated, file-like sickle teeth. Here is certainly a wide field open for the labors of ingenious inventors. May not some metal or composition be discovered that will cover hard metallic surfaces completely, and renthem microscopically smooth and perfect? The so-called "metalline" which has been offered for this purpose is not understood to be a complete success, or any success at all for heavy journals. Occident.

[There seems to be a certain "periodicity" about inventions. Certain things are re-invented in recurring cycles, from some cause which is not understood. This year the almanac ought to contain the following prognostic: "Loose wheels may now be expected." They have been tried over and over again on railroads and always abandoned. Inventors invariably refer to common road vehicles to show how easily the wheels will turn round a corner. The conditions under which they work and those of railroad wheels are entirely unlike. The former are at liberty to run where they choose; the latter are confined to two rails, and in order to run on them, their axis must be perpendicular, or nearly so, to the track. If the wheels are loose they will be at liberty to run either way, independent of each other, so that their axis is liable to become skewed on the track, if one wheel meets with an obstruction when the other does not. To illustrate this, suppose two wheels which are loose on an axle are placed on a straight track. If an obstruction, say a stone, is placed under one wheel the other can then be rolled ahead until it leaves the rail, and yet hardly move the wheel which is obstructed, as the axle will turn in hub without any other effect. Suppose, however, that the two wheels are fast in the axle; then if the unobstructed wheel is rolled, the other must either slip on the rail or else be rolled over the stone, most probably the latter; so that, when wheels are fast on the axle, the one which meets with an obstruction is always helped out of it by the one which does not. This is the chief reason why loose wheels cannot be used. The difficulty of keeping the gauge of their flanges uniform is another trouble, and of taking up the lost motion which must inevitably result from the wear in the hubs is still another. —Ed. Railroad Gazette.]

Baron Von Weber's Experiments on the Stability of Permanent Way.

[Continued from Page 245.]

We have now to consider the experiments relating to question (*f*) namely: "What power is required to displace a fastened and loaded rail horizontally on its sleepers?" It would have been impossible to entirely overcome the difficulties attending these experiments otherwise than by employing apparatus of a complicated kind, and this would have given rise to new inconveniencies, and would have in certain ways increased the uncertainty of the results. In fact, it was considered by Baron von Weber that the only way of obtaining results of any value was to apply the displacing power so that it acted against the rails as nearly as possible in the plane of their bearing surface, as otherwise a canting action would have been set up, and this, of course, was just that which it was desired to avoid. But even when the displacing power was exercised exactly in the plane of the bearing surface, it was found that as soon as the least displacement took place the inclination of the outside spikes caused the rails and sleepers to be forced apart; and the base of the rail was thus made to bear on the spikes not close to the surface of the sleeper but higher up, and the stability was thus diminished. Notwithstanding the difficulties in the way of getting exact data, however, the results obtained in these experiments are of interest, as showing approximately the resistance of the spikes to a shearing action exercised in the direction of the surface of the sleepers.

The experiments were made by the aid of the small hydraulic press previously mentioned, this press being firmly bedded between the rails in the manner shown by Figs. 16 and 17. The axis of the press coincided with the plane of the underside of the lower flanges of the rails.

19th Series of Experiments. Two pieces of rail were fastened, with the usal cant of 1 in in 20, upon two new fir slepers placed 2 ft. apart; the fastenings consisting of eight spikes, having sides ½ in. wide, and driven 140 millimetres (=5.5 in.) into the wood, 30 millimetres (=1.18 in.) of this length having wedge shaped edges. The displacements measured at the points where the base of the rail was held by the spikes were as follows:

Pressure applied. centnrs. lb.	Displacements. mil. in.
10=1,134	1.0=0.039
20=2,269	1.5=0.059
25=2,836	3.0=0.118
30=3,403	4.5=0.177
40=4,537	5.0=0.197
45=5,105	6.0=0.236
50=5,672	12.0=0.472
55=6,239	18.5=0.728

At the conclusion of these experiments, the rail had risen 2 millimetres (= 0.078 in.) from the sleepers.

20th Series of Experiments. In this series the same rails, as above used, were fastened by sixteen spikes to four sleepers placed 3 ft. apart. The displacements, which were measured on the sleepers nearest the press, were as follows:

Pressure applied. centners. lb.	Displacements. mil. in.
10 = 1,134	0.5 = 0.020
20 = 2,269	4.5 = 0.177
40 = 4,537	10.5 = 0.413
55 = 6,239	25.0 = 0.984

The less resistance shown by the last-mentioned results, as compared with those obtained in the preceding series of experiments, is attributed by Baron von Weber to the inferior quality of the timber of the sleepers.

21st Series of Experiments. In this case the press acted, at the center of their length, against two 18 ft. rails fastened in the ordinary way to seven new and sound fir sleepers, these rails forming part of a continuous line fished with steel fish-plates. The displacements were measured upon the sleepers, *a*, which were next the press, and also upon the two sleepers, *b*, which came next to sleepers, *a*, and upon sleepers *c*, which came next to sleepers, *b*. The results are subjoined:

Pressure applied centnrs. lb.	Displacements. Sleepers *a*. mil. in.	Sleepers *b*. mil. in.	Sleepers *c*. mil. in.
15= 1,701	1.5=0.059		
20= 2,269	2.0=0.078		
30= 3,403	3.0=0.118		
40= 4,537	6.0=0.236	1.0=0.039	
50= 5,672	10.5=0.413	4.5=0.177	2.0=0.078
60= 6,806	16.0=0.629	7.0=0.276	4.0=0.157
70= 7,940	25.0=0.984	10.5=0.413	7.2=0.293
8 = 9,075	34 5=1.358	25.0=0.709	12.0=0.472
90=10,210	48.0=1.890	25.0=0.984	14.0=0.552

The displacements observed on the other sleepers were insignificant, and, when the pressure was removed, the permanent displacements were found to be:

on sleepers, *a*, 15 millimetres=0.59 in.; on sleepers, *b*, 8 millimetres=0.315 in.; and on sleepers *c*, 7 millimetres=0.276 in.

Although the series of experiments we have just described are not extensive, Baron von Weber considers that the following deductions may be drawn from them: 1st. That the resistance of the spikes to the horizontal displacement of the rails upon the sleepers is proportiately so insignificant that most of the movements of the rolling stock which would be capable of producing a displacement of the rails on the sleepers would suffice to overcome this resistance; and, 2d. That the power of resistance of the spikes to horizontal displacement decreases, after that displacement has once begun, in a more rapid ratio than the displacement itself increases; and hence that the continued action of the rolling stock will produce generally greater displacement than a sudden and great pressure or force.

The experiments relating to question (*g*)—namely, "What force is required to draw the spikes out of the sleepers?" deal with some of the most important questions relating to the stability of permanent-way structures, for more than 90 per cent.

FIG.18

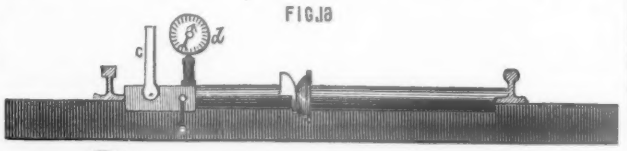
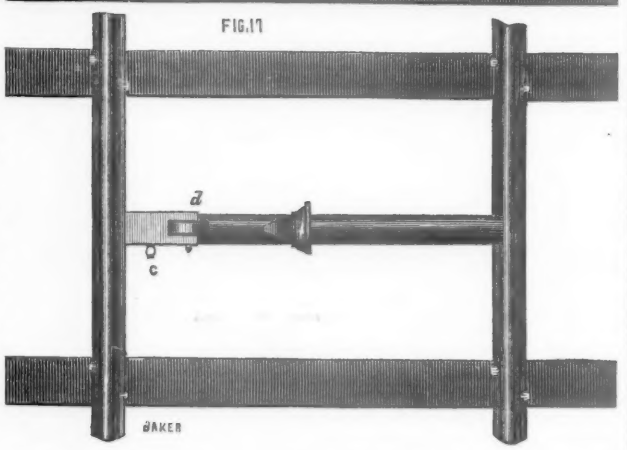


FIG.17

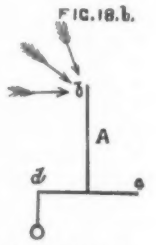


of the disturbing actions produced by the passage of the trains over the rails, tend to produce a canting of the latter either by the lateral or more or less horizontal pressure of the tires against the rail heads. In fact, the pressure of the wheels of vehicles traveling with more or less oscillation seldom acts directly vertically upon the base of the rails, and even if sometimes such a direct vertical pressure should be produced, the elasticity of the supports upon which the rails rest, always allows of a certain impression of the bases of the rails into these supports, and changes the vertical pressure into one acting at a more or less acute angle. The stability of the rail in respect to its supports depends therefore upon the strength of the fastenings by which it is secured in its normal position, whilst it is also affected by the proportion between the height and the width of the base of the rails. In the case of the flat-footed or Vignoles rail, this proportion is to a certain extent governed by the requirements of the system of manufacture; while on the other hand, it is one of the advantages of the chair system that the depth of the rail may be increased to any required extent without affecting this proportion, the base of the chair being correspondingly extended laterally.

The power exerted by the rolling stock upon the fastenings of the rails depend upon the proportion of height of rail to width of base just mentioned, for each rail may be considered as a bell-crank lever, of which one arm is formed by the head and web, and the other by the base, or bottom flange. The forces brought to bear upon the rail act either horizontally or at a more or less acute angle from above towards the point, *b* (see Figs. 18 *a* and 18 *b*), and tend to turn the rail round the point, *c*, which thus forms the fulcrum, while the load suspended at *d* represents the holding power of the spikes. If this holding power be increased it is evident that, theoretically, the ratio of width of base to height of rail can be proportionately decreased without affecting the stability of the structure; or, in other words, the height of the rail may be made as great as the resistance of the sleeper to compression by the base of the rail will allow. Although all this appears very simple in theory, the question is nevertheless complicated in practice by the compression of the timber under the rail, this compression being mostly greatest under the point, *c*, whence the rails have to be considered as resting on a more or less inclined plane which favors their canting, but the inclination of which differs according to the load upon the rails and the nature of the timber of which the sleepers are composed.

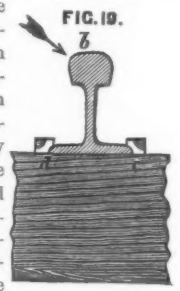
FIG. 18 a.

FIG. 18. b.



Without loosening the spikes at *d*, Fig. 19, the impression of the edge of the base into the sleeper at *e* produces a partial canting, which disappears again on the removal of the lateral pressure. But we have already seen from Baron von Weber's investigations, how much the sleepers may be compressed, particularly at those points where the rails have rested for some time, and the sudden canting of the rails may, therefore, under certain circumstances, be sufficiently great in amount to be the cause of accidents. The forces tending to produce canting of the rails in this way cannot be easily ascertained, even approximately, by experiments.

FIG. 19.



Baron von Weber considers, however, that it is of greater importance to ascertain by experiments the forces required to draw the spikes, d, at the inner edge of the base of the rail, out of the sleeper, and to determine the effect produced by placing a greater or less number of thin sheet-iron plates upon the sleeper at *e*, so as to prevent the indentation of the wood. It would have led to too extensive a series of experiments to have tested the holding power of all the various forms of spikes and other fastenings used on different lines, and Baron von Weber, therefore, confined his own investigations to ascertaining the holding power of square, prismatic spikes with chisel-shaped points; while he records in his work the results obtained by other experimenters who before him had tested similar spikes and other fastenings.

Baron von Weber states that the first experiment on the holding power of spikes, which were really made in Germany for the purpose of obtaining the best fastening for rails, were carried out in 1856, by Herr von Kaven, now of Hanover. Karmasch, the director of the Polytechnic School at Hannover, had previously made some interesting experiments for ascertaining the resisting power of small pyramidal nails driven 2 in. into timber, and he found that the holding power in pounds of such nails was to be obtained by multiplying their surface in square inches, by the following numbers:

Description of wood into which the nails are driven.	Nails driven into the wood in the direction of the grain.	Nails driven into the wood across the grain.
White Pine	450	800
Lime	450	850
Beech	870	1,350
Hornbeam	1,050	1,418
Oak	1,300	1,800

We shall examine presently how far the rule above given for the holding power of pyramidal nails applies to ordinary spikes.

Von Kaven's experiments were made with great care, and before carrying out his investigations respecting rail spikes, he made many other experiments for determining the holding power of nails of various kinds. He introduces his account of his experimental researches by an elaborate theoretical investigation of the forces giving the holding power, but as this investigation involves some somewhat lengthy equations, it would be out of place to introduce it here, particularly as Von Kaven himself acknowledges that the results obtained by theory but seldom coincide with those obtained in practice. Von Kaven's experiments were made only for the purpose of determining the resisting power of nails or spikes to a force tending to draw them direct out of the timber, the resistance against a lateral displacement not being taken into consideration; but, notwithstanding this, the results obtained are of considerable value. Those relating to rail spikes are systematically arranged in the annexed table:

TABLE SHOWING THE RESULTS OF VON KAVEN'S EXPERIMENTS.

DESCRIPTION OF SPIKES.	Dimensions.		Resisting power.				Length from lower surface of head to point of spike.....	Depth driven into the sleeper.....	Weight of a spike.
			Deal.		Oak.				
	Width.	Thickness.	With the grain.	Across the grain.	With the grain.	Across the grain.			
	in.	in.	lb.	lb.	lb.	lb.	in.	in.	oz.
I. Square spike for joints	....	....	4,128 *2,884 **2,814	3,448 *2,804 **2,719	9,919	7,848	8¾	5.83	10.
At *a* under the head	0.56	0.54							
" *b* in the middle	0.54	0.51							
" *c* 2 in. from point	0.48	0.40							
" *d* point	0.40	0.40							
II. Square spike for joints	....	....	3,255	3,215	6,165	6,105	7	4.66	11.
At *a*	0.66	0.66							
" *b*	0.62	0.63							
" *c*	0.62	0.62							
" *d* 1½ in. long	0.62	0.10							
III. Square spike for intermediate sleepers	....	....	2,454	2,614	5,475	6,315	6	4.33	8.
At *a*	0.53	0.53							
" *b*	0.53	0.52							
" *c*	0.53	0.52							
" *d*	0.54	0.20							
IV. Chair spike	....	....	3,463	3,413	6,025	5,925	7	4.66	12
At *a*	0.64	0.64							
" *b*	0.62	0.62							
" *c*	0.62	0.62							
" *d*	0.5	0.2							
V. Triangular spikes	....	....							
Point ⅛ in. long { Side of triangle 0.64 in	....	....	2,548	2,548	5,415	5,415	5½	3.66	6½
" " " 0.60 in	....	....	2,988	2,988	6,315	6,315	6	4.33	9.
VI. Triangular spikes; each edge turned 180°, the spike moving freely round when drawn out.									
Side of triangle, 0.64 in	....	....	2,298	2,298	4,794	4,794	5½	3.66	6½
" " 0.60 in	....	....	2,835	2,835	6,965	6,965	6	4.33	9
VII. The same spikes, but prevented from turning round during the drawing out	....	....	2,535	2,535	5,625	5,625	5½	3.66	6½
	....	....	3,235	3,235	7,413	7,413	6	4.33	9.

NOTE.—The triangular spikes were from the permanent way of the Munster-Rheiner Railway.
The resisting power of the square spike, I, was probably so great in the direction of the fibres, because the largest dimension of the spike penetrated then against the cross fibres, for "width" means the dimensions in a direction normal to the direction of the nose. The spikes marked * were not annealed and were driven into the timber for the second time, whilst the spikes marked * * were driven into the timber for the third time.

It will be seen from this table that the holding power of spikes of the kind referred to cannot be calculated with even approximate accuracy by Karmarsch's rule for the resisting power of pyramidal nails of small size. In fact the holding power of spikes is very much smaller than that obtained by Karmarsch's rule, as, for instance, the first spike referred to in Von Kaven's experiments required, in order to draw it, a force of but 4,128 lb., whilst a force of 10,000 lb. would have been necessary according to Karmarsch's rule. Baron von Weber considers that Von Kaven's experiments distinctly prove:

1. That, other conditions being the same, the holding power of spikes is twice as great when driven into oak as it is when they are driven into fir.
2. That spikes driven into the timber for the first time possess a greater holding power than those which have been drawn out and re-driven several times.
3. That the coefficients for the calculation of the power of spikes to resist being drawn out of timber are about 300 lb. for fir and 600 lb. for oak per square inch (46.8 lb. and 93.6 lb. per centimetre) of the surface of that portion of the spike driven into the wood.

These coefficients agree approximately with those given by Karmarsch for calculating the holding power of cylindrical wire nails, Karmarsch's coefficients being:

	Pounds per square inch of surface.
For White pine	270
" Lime	300
" Beech	580
" Hornbeam	600
" Oak	580

These coefficients also prove that oak gives twice the holding power of deal; but, as is remarked by Baron von Weber, they also show the peculiar anomaly that the resisting power of cylindrical nails should be less than that of pyramidal nails, a result directly opposed to the teachings of practice. Von Kaven advises that extensive experiments should be made with spikes which had been driven into timber for some time, as the resisting power of such spikes will, he remarks, probably differ greatly from that of spikes drawn immediately after being driven. How far this advice has been taken, and how far the influence of the traffic as well as of the shrinkage and swelling of the sleepers, oxidation of the spikes, etc., has been taken into consideration in determining the resisting power of spikes in actual practice, will be seen when we speak of Baron von Weber's own experiments. Previous to doing that, however, we must give some account of the extensive and searching investigations made with the same object on the Hanoverian Railway, by Herr Funk, one of the most prominent railway engineers in Germany. Of Herr Funk's investigations, which are amongst the most important of the kind ever made, we shall speak in our next number.—*Engineering.*

[TO BE CONTINUED.]

—John P. Cox, Superintendent of the Pennsylvania & New York Canal and Railroad, died at Waverly on the 7th inst. of apoplexy.

—A new bridge over the Illinois River at Henry, Marshall county, was completed on the 3d inst.

"Locomotive Performances."

Under this head, Mr. A. Alexander, of Worcester, writes as follows to *Engineering:*

In 1855, while at Quebec, I drew up a report addressed to the chief agent (Mr. Hodges) of the contractors for the works and rolling stock of the Grand Trunk Railway of Canada. In this report I noted the influence of the bogie in mitigating the effect of bad roads; contrasted the working of engines so fitted with those up to that date delivered to the Grand Trunk Company, of the ordinary English (Crewe) type, and strongly recommended its adoption for the engines yet to be supplied by the contractors. Up to that time a very general idea prevailed in England, that "bogies" were serviceable chiefly for railways with bad curves. Very shortly after this report reached England, the recommendations contained therein were carried out; and I have reason to know that the change was most satisfactory both to the Grand Trunk Company and to the contractors. In fact, I believe that subsequently all the single leading wheel engines previously delivered to that company were altered by them to the bogie system. From this it may be inferred that I fully concur with Mr. Evans in the eulogium he has pronounced in your issue of the 11th inst., upon the bogie as applied in America. I have frequently felt surprise that it has not been more extensively used in this country, believing that American engines, as a rule, treat the "track" much more tenderly than English locomotives, and hence that a more general adoption of "bogie" principles would greatly tend to diminish cost of maintenance of the so-called permanent way. But this notion does not always commend itself to all engineers, even upon trial. In illustration I may mention that some years after the above date I recommended and sent out from England to Denmark a bogie to be fitted to one of the engines on the then Royal Danish Railway, since Prussianized.

The superintendent of the line complained of the weight on the leading wheels of these engines as being too much for his light road. The engines had been made at the Railway Foundry, Leeds (since vanished, alas! to the region of dim legends and distant memories), of the well-known type adopted by J. V. Gooch, then of the Great Eastern Railway. I supposed that there could be no doubt of the advantage of the bogie in such a case, but the report which reached us in due course intimated that, though the bogie gave perfect satisfaction, yet the engineer was not prepared to recommend its adoption for the other engines, as he did not see any such superiority in it as to justify the expense. Among other points, also, it was urged that the bogie used up more oil than the single leading axles; whereas our experience on the Grand Trunk had been often the very reverse. From this it is clear that even familiarity with the advantages of the bogie system does not lead in all cases to a desire for its universal adoption. Referring now to Mr. Evans's letter, I do not think that any line with gradients less steep than 1 in 20 is entitled to the name of a "mountain railway," but in these, and on all ordinary lines with stiff gradients and sharp curves, where heavy loads are to be drawn, the bogie in some shape or other must be introduced. In comparing the American type of locomotive with the double bogie engine advocated by Mr. Fairlie, I do not see how the former can take so heavy a load as the latter, equal weights of engine and tender being supposed in each case, as in the Fairlie engine the whole weight is utilised, whereas (not to speak of the tender) whatever weight rests upon the American bogie is lost for adhesion. On the other hand, in severe curves, it is possible that with the American engine there may be less damage to the road in consequence of the diminished leading wheel weight which I consider (so far as regards maintenance of way) much better than perfect equalization; and whether the utilisation of all the weight for adhesion will compensate in all cases for the extra cost and complication of two sets of gearing is a question on which difference of opinion may fairly exist.

We cannot, as you have pointed out, accept Mr. Evans's figures without modification, and as any conclusive trials of the merit of different engines, especially in the absence of a recognized standard, must be made on the same road and at the same time, so as to avoid different states of weather, I do not know that any correct conclusion can be arrived at from Mr. Evans's interesting table. It is probable, however, that although but one meaning can attach to Mr. Evans's words, yet his real intention was to intimate that all fair comparison between engines should be based on the number of foot-pounds of work done in overcoming resistances, not necessarily in *lifting* the train, as the whole force of the engine may be developed without lifting the train at all. If this be the meaning he intended to convey, I entirely agree with him, but consider (with you) that the mechanical effect should be stated per ton, not on the drivers merely, but of the whole engine and tender.

It is greatly to be desired that some standard of this kind were more frequently referred to, as it forms the only basis on which the probable cost of working on very severe gradients can be reckoned, or different systems of traction compared. The mere statements of cost per mile, or per ton per mile, so common in English accounts, are of no service whatever when gradients of exceptional stiffness are to be worked; but it is to be hoped that ere long some definite information given of the cost of developing on ordinary English lines a definite amount of tractive force over an uniform distance, as, say, 1,000 lb. over a distance of one mile, which may be called a traction unit. This is, in fact, a definite duty which cannot be affected by any change in the character of the line. Neither is it dependent, except to a limited extent, upon the speed at which the work is performed.

It is true that if we find the same tractive force—say, 1,000 lb.—developed over one mile in one half the time, this implies a double power in operation, and in the *same time* the cost is doubled; but the space traversed being doubled also, the cost per one mile remains the same. I, of course, exclude from consideration the power required to communicate velocity to the mass of the train, a great part of which is practically lost, but for all, except the shortest runs, the amount is so comparatively small that it may be neglected.

While it is chiefly to direct attention to the subject on the part of those favorably situated for obtaining some precise knowledge of this railway "constant," that I have ventured to write you, I cannot but express a hope that Mr. Fairlie may see his way to take up the gauntlet hurled across the Atlantic by Mr. Evans, not assuredly "for the fun of the thing" (the days of chivalry are gone), but in the interest of locomotive progress and sound system of construction all over the world.

Rating Steam Engines.

It scarcely needs any argument to convince an intelligent mind that all statements of fact are valuable only as they are definite. The present system of rating steam engines by horse-power is, however, as indefinite as can well be conceived. When a manufacturer rates an engine at eight horses' power or ten horses' power, he generally has in his mind some general average of pressure in the boiler, and some regular speed of piston, but as both these factors are variable, his rating may be below or above what the engine will do in practice. Care is generally taken to rate engines below their capacity.

The old term, nominal horse-power, is still adhered to, particularly in rating marine engines, and though this gives some idea of the dimensions of the parts of a steam engine, it gives no idea of its real power.

Of a surety this indefiniteness is a disgrace to so accurate a science as that of steam engineering, in which everything else is now reduced to the finest possible measurement; and there is not the slightest valid reason why it should exist a day longer. There need not, it seems to us, be any difficulty in agreeing upon some standard pressure and number of revolutions, or what is the same thing, speed of piston per minute, at which the power should be computed. This would at once remove the uncertainty of which we complain, as the power for higher or lower speeds and pressures would then be easily determinable.

We suggest as a convenient standard of initial pressure in the cylinder sixty pounds, and one hundred as a standard number of revolutions per minute. Engines could be then rated to the number of revolutions above standard they could be run, and this, with the pressure the boiler can safely carry, would enable the purchaser to at once calculate the maximum power available with an engine of a given rating.

There is also no necessity for adherence to the horse-power as a unit. The foot-pound is the adopted unit of work in all modern treatises on physics, and the expression of the power of engines in foot-pounds saves one division in the computation. We think it is time that "nominal horse-power" and "actual horse-power" should become obsolete terms. For all scientific and practical purposes the foot-pound is by far the most convenient.

These standards of measurement being once generally adopted, purchasers would have something tangible to guide them. There need be no mistakes made, as is now often the case, such as purchasing an engine of too great capacity for the steam producing power of the boiler designed to supply it, or the buying of engines of insufficient capacity to do the work desired. On the contrary, accurate guarantees of power might be demanded and given.—*Scientific American.*

—An impostor representing himself as J. L. Kime, who is a respectable and honest conductor on the Northern Central Railway, has been traveling about the country, obtaining passes, imposing on hotel keepers, and marrying or promising to marry women, while all the time the true Mr. Kime has been at work on his road. Railroad men should be on the watch for him.

The Fairlie Engine—Mr. Fairlie's Reply to Mr. Evans.

We published on page 151 of the current volume of the Railroad Gazette, a letter from Mr. W. W. Evans to *Engineering*. We give below Mr. Fairlie's reply, which is given in *Engineering* of November 18. The reader should refer back to Mr. Evans' letter:

Sir: I have seldom, if ever, read "taller" writing than that which appeared in your last week's impression, signed by "W. W. Evans." What a pyramid your correspondent has raised on a foundation of sand, which in your excellent article you have tumbled to pieces.

He evidently does not fully appreciate his own theory, or he would have removed the coupling rods of his engines, and have worked them with one pair of driving wheels only. In this way, according to his showing, what a splendid result he would have obtained!

I wonder what Mr. Fell will say to this reasoning, who, according to his experience of mountain railways, assures the world that no gradient lower than 1 in 20 can be worked without not only the adhesion arising from all the weight of the engine, and store, fuel, and water, but an additional adhesion equal to as much more at least by the employment of a central rail and horizontal wheels. Mr. Fell says you must have an adhesion equal to double the weight of the engine and tender if there is one, which can only be obtained artificially by means of his mid-rail and horizontal wheels set up by springs; whereas Mr. Evans proves in the case of the "Conquistador" that barely one half, and in that of the "San Bernardo" that about one-third of the weight of the engine and tender only is required for adhesion. Which of these gentlemen is right?

One of my chief objects is to do away with tenders of locomotives, to make each engine carry its store of fuel and water on its back, and to do this in such a manner as to get all the advantages which large quantities of these give for long runs, at the same time not to overload any one wheel, that all shall be loaded alike, and that having this weight so equally distributed it is available for adhesion. Should it happen, as it often does, that you do not require so much adhesion, yet when no injury is done to the principle of the locomotive by having it, and it is always to the fore when you do require it, I maintain that it is an enormous advantage so to have it. It may be said that ordinary tank engines give the same advantages, and no doubt they do to a limited extent; but the case of an ordinary tank engine and the Fairlie engine is so totally and widely different that there is no comparing them, the former is a sort of rolling, tumbling, galloping machine, terribly destructive by its oscillating movements, alike to the rails as to itself, and carries but little water and fuel, whilst the latter is exactly the reverse of this in every particular.

I do not include in the above character of the ordinary tank engine Mr. W. Adams's plan of bogie tank engines. These engines run remarkably steady, and therefore are much less destructive to themselves and the road than the ordinary tank engine, and are at the same time more economical in fuel. The smoother the motion of an engine when moving the greater the economy in fuel, in maintenance of way, and in maintenance of the machine itself, whilst a rollicking engine is expensive in all these. The American bogie engine and Mr. Adams's engine are on a par in this respect; they are better, safer, and cheaper for any road than the rigid wheeled engine, but in neither of these engines can you avail yourself of the adhesion of its full weight. In each case the bogies can only be used for carrying one end of the machine, and therefore are useless as regards adhesion.

The double bogie engine is just as superior to either of these types as they are to the rigid engine. It does not require a philosopher to know this. If one bogie gives such good results, two bogies must be better, because they naturally conform more readily to the curvature or inequalities of the road than the single bogie, with the single bogie the centre line of the boiler must always be a tangent to a curve, whilst with the double bogie it is the chord.

I am lost in amazement at Mr. Evans' mode of dealing with the double bogie, he is so carried away in his enthusiasm for his pet engines, that he altogether forgets the principles of the machine which he discusses. What a graphic description he gives of the 50,000 miles of railway over rolling prairies, trackless bogs, and endless forests, with eagle eyes and sleeping passengers, forgetting that the safety of the latter is due principally to the *double bogie*. Surely if it is good in one case it must be good in the other. Now, suppose he takes one of his sleeping cars, and fixes one of the bogies so that it cannot swivel on its axis, leaving the other free as before, he then has a correct type of his engine. Let him then put his sleeping passengers into the cars with one bogie rigidly fixed in this manner, and in a very short time, I ask him, where would the sleeping passengers find themselves? I venture to say they would soon have their eyes opened with a vengeance. This being so, why then should the double bogie, so useful, so effective, and so safe in the passenger cars, be so radically wrong in the locomotive engine as Mr. Evans tries to make it out to be?

It is only another proof of the blindness which overtakes all who persistently hold up their own child as being the most beautiful in creation, without looking to see if there are not others as beautiful.

I make it a rule to calculate an engine as of two forces, one the steam force at the periphery of the driving wheels, the other the adhesive or griping force on the rails. Of course it is absurd to call the latter a force, but I use the expression merely to show that this is a distinct element in the locomotive, and quite as essential to developing its power as the steam itself.

As an instance of this, it will be remembered that the very serious accident which happened in the Black heath tunnel arose entirely through the want of adhesion of the engine which entered the tunnel with a ballast train, and which, after going some distance in it was pulled up by reason of the wheels slipping. In this predicament a passenger train was allowed to enter the tunnel, and ran into the ballast train, killing and injuring some of the passengers. In the evidence respecting this accident it was proved that the engine was unable to pull the ballast train, although the driving wheels of the engine were revolving nearly the whole time, notwithstanding which the train remained stationary. This evidence clearly proved that under the circumstances of the state of the rails in the tunnel, at that time there was no balance between the adhesive force and the steam force. Had this been so no accident would have occurred and no lives lost.

I merely state this to show that in this instance adhesion was of more value than the steam power, and that by want of it an engine could not pull its train, and that life was sacrificed in consequence.

The principle I adopt in working out the power of an engine is to make these two forces balance each other as near as possible. I assume a mean pressure of 100 lbs. to the inch of cylinder, at 10 miles an hour, to get the steam force at the periphery of the wheels, and a coefficient of adhesion or "sticktion" to the rails of one-sixth of the insistent weight of the machine, with half supply of store, fuel and water. The following are a few examples of Fairlie engines selected as instances of this balance of forces:

	Steam force at rails.	One sixth of the insistent weight on driving wheels is
	lb.	lb.
"Little Wonder"	6,300	6,339
"Progress"	18,400	18,600
"Mountaineer"	8,600	8,600
"Tarapaca"	21,000	20,160
"Hultenheim"	9,0 0	8,400
Livny Engines	15,000	14,300
Tamboy Saratoff Engines	20,000	19,800
The Great Russian Engines	24,400	25,000

With regard to the queries in Mr. Evans' letter, to the first I answer, because the Fairlie engine never existed until I invented it; to the second, I say the engines he refers to are totally different in principle to mine, and this leads me to say here that it is really a pity that a clever man like Mr. Evans should attempt to discuss the merits of a principle he does not evidently understand; did he do so, he could not have made the comparisons he has—I might say blunder—in making the comparison.

The third is answered in the second.

The fourth has no reference whatever to the subject.

The fifth you have answered most truly. I will only add that I had nothing to do with the design of these engines. I never saw the engines, and although I tried very hard to get a sight of them, I was not allowed to do so. I answer

The sixth, by saying the "Progress" was assumed to weigh 44 tons when first built and put to work. I afterwards altered the engine, and made larger and additional tanks to cary more water, and strengthened the coupling frames, between the bogies. After these alterations, the weight was taken at 54 tons. The late Mr. Colburn put the engine on an ordinary engine weighing machine, with three separate platforms or tables for weighing each of six wheels separately. Consequently, the four wheels of one bogie stood on the extreme inner sides of two of the tables, which were thus pressed down on one side, and raised up at the other; hence, this style of weighing was no criterion of the actual weight of the engine. Since then, however, I have had every bolt and pin of the "Tarapaca" most carefully weighed. This engine carries more water than the "Progress," has nearly half as much again firebox surface, has twelve wheels against eight, and is altogether a larger engine, and weighs 59 tons exactly in working order. It is clear, therefore, that 54 tons is quite as much, if not more, than the actual weight of the "Progress."

With respect to the seventh, all I can say is, the proof of the pudding is in the eating of it. The tires of the "Progress" at the flanges are as good now as when the engine first left the workshop; the tread is worn a bare 1-16 in. hollow, and this only after about five years' work. I maintain, therefore, that the "Progress" with 6¾ tons per wheel is less injurious to itself or the rails than an ordinary engine wheel would be with 4 tons upon it.

Regarding the eighth query, I am quite satisfied that rails with Fairlie engines working over them of the same power as ordinary tank engines will wear "fully three times as long." Suppose a tank engine on six wheels to weigh 36 tons, a Fairlie engine on twelve wheels to give out the same force would weigh 40 tons, because of the extra wheels. We have, then, in the one case, 6¾ tons per axle, and in the other, assuming the impossible condition with ordinary engines, that the wheels are loaded equally, 12 tons per axle. Then, if the effect of oscillation of the tank engine is taken into account, and this is doubled, as it is at times, according to those very elaborate experiments carried out by Baron von Weber, and commented on in your journal of the 25th March, 1870, and which quite accord with all my own experiences in this direction, we have thus an engine plowing along always with 12 tons on each axle, but constantly increasing this to any weight up to as many tons per wheel, as against the 6¾ tons per axle. or under 3½ tons per wheel of the Fairlie engine, which, by reason of the perfect distribution of weight, and the absence of all oscillation, through the principal weight being carried on the centre of each bogie, and this, again, central between all the wheels (although it is increased a little by the oscillation of the bogie itself), continues nearly the same under all circumstances of working. Will Mr. Evans say how much longer than three times the rails will last under these circumstances?

You will perceive, on carefully reading over this query of Mr. Evans' that he has got somewhat demented about bogies generally.

In regard to query nine, I find the autograph letter Mr. Evans alluded to was one written by me to a Mr. Meiggs, in Lima, South America, and was not addressed to Mr. Evans; neither was it, I feel assured, sent to Mr. Evans to be made use of in the way he has made use of it. This is only another instance of the rather unscrupulous mode Mr. Evans adopts in dealing with private communications which is scarcely yet recognized in this country, and I doubt much whether it is so recognized in America. On referring to the copy of the letter in question, I find I used the words "breathing places" in lieu of the term "coal and watering stations," to get supplies of these, and, if necessary to rake out and clear the fire; this term was used when writing with reference to working a very long gradient of 1 in 27 with maximum loads, and it will be readily understood that for such very heavy work coal and watering stations, not too far apart, are essential to careful working—or to use the phrase quoted, "breathing places"—at stated intervals. Mr. Evans does not achieve very much out of this mare's nest.

To the 10th I reply that all who were invited attended. The experiments were made at the request of the Russian Commission. The latter part of this query contains observations, which may be uttered with perfect impunity, regarding all new plans. It is, I fancy, human nature to oppose doggedly all new schemes. Even if they emanated from heaven they would be opposed, and by none more so than those engaged in the pursuits for whose advantage the new schemes are invented. Mr. Evans evidently understands human nature in this respect, and makes what he knows must be a safe shot. Instance the opposition by ironmasters to Mr. Bessemer's improvements. Yet who has benefited more by his improvements than the ironmasters? Also the opposition to the Giffard injector by locomotive engineers. Yet who has benefited more by its introduction than locomotive engineers? I could multiply cases without end to prove that the more violent the opposition, the more intrinsic value there is in the invention opposed. One could say, with some security of being right in saying it, that the value of any new scheme is in direct proportion to the opposition its introduction meets with.

To the 11th I say that from the great number of experiments I have made to determine train resistance, I have found that 10 lbs. per ton is the nearest and best average for trains on English lines, taking an average line with minimum curves of 1,000 ft., and a speed of 10 miles an hour. I include in the 10 lbs. per ton all train resistances at this speed, and when it is considered that all kinds of stock get jumbled together into trains, it will be found to be rather over than under 10 lbs. per ton. I am, however, convinced from what I saw on the Reading Railway in America, that the train resistance with the bogie stock is nothing like so great as it is with us, else their engines could not do the duty they are represented to do, and that I saw them do. An American engine will, and does, really give out a force of from 10 to 40 per cent. more than any of our English types of locomotives of the same cylinder power, that is, assuming the same resistance in each case; but as there cannot possibly be so great a difference in the two classes of engine (although I am quite satisfied there is a difference in favor of the American type), it follows so great a difference must be due to a reduction in the train resistances. This was clearly exemplified in a paper on American rolling stock by the late Mr. Zerah Colburn, read before the Institution of Civil Engineers, which was, and still is, contrary to our English experience.

With regard to the 12th question the cost of the Fairlie engines is about 10 per cent. less per horse power exerted than the ordinary engine and tender.

The 13th query was evidently written as a joke by some sporting individual during the temporary absence of Mr. Evans from his office.

The 14th you have definitely wiped out, and as to the 15th and last, I have only to say that Mr. Evans has evidently made good use of his time while engaged on mountain lines to get some dollars together. I am very glad of this, and would advise him to keep them. I regret to say my dollar arrangements are somewhat limited, and are barely sufficient at present to meet my requirements. I have no doubt if Mr. Evans had devoted five years of his life to introducing a new system requiring a heavy expenditure per annum he would be more chary of his dollars. But had I ever so many dollars to spare I question whether I should feel justified in having anything to say to a man who dodges his results, and who believes so firmly in his own type of engine, which he thinks so immaculate that if an angel from heaven told him he was wrong he would not be convinced. However, by-and-bye the "Tarapaca" will be at work in Peru, where his pet engines are, and the comparative results of work done and fuel consumed for each ton of work done will at all events prove to others (I have no hope of Mr. Evans), how great and many are the advantages of the Fairlie type over anything yet produced in the shape of locomotives.

But why does Mr. Evans not go to Taunton, Mass., and see a Fairlie engine built by Mr. W. Mason, as I have asked him to do? He can no doubt there have an opportunity of spending his money with those who well understand Mr. Evans's mode of dodging experiments, and who will not object to ease him of a little of it. He can there back his pet engine against the "Janus," and no doubt he will find those who are both able and willing to try a tilt with him.

What has surprised me more than anything in Mr. Evans's letter is the bitter, I may say splenetic, tone which pervades it.

I have never seen Mr. Evans, have never crossed his path or trod on his toes to my knowledge. Then how account for this bitterness? Fair argument is all in order of course; but when personal animosity is introduced it becomes no longer argument nor deserving the appellation.

This is not only my view of Mr. Evans' mode of dealing, but it is that also of the Convention of Master

Mechanics (that is Locomotive Superintendents) in America. It appears that at the annual convention of the American Railway Master Mechanics' Association, a similar institution to our Institution of Mechanical Engineers, according to the report in the *American Railway Times*, Mr. Evans read a paper on the Fairlie Engine, of which the report states that the "Convention refused to place Mr. Evans' paper upon the records because it was too personal."

The following extracts from the same paper admirably illustrate Mr. Evans' Style: "The *fact* is that Mr. Fairlie is not the real inventor of this locomotive." "A similar engine was invented by Cockerills at Skraing (meaning Seraing), in Belgium, eighteen years ago," "It proved a failure in the Austrian fairs" (what the latter are I do not know). "Mr. Fairlie knows that he is not the inventor." "Similar engines have been used in France and long since abandoned" (this is a gross fabrication; it, however, only shows how utterly reckless Mr. Evans is in his statements, and how regardless of truth). "The only one ever made in England has been exhibited to a host of lords and barons, but is now voted a failure." "It *would not run* around corners, and had finally to be towed back to the engine house." (Listen to this ye thousands who have seen my engines running around the 50 ft. curves in the cabbage garden.) "If Mr. Fairlie's 'Little Wonder' locomotive can compare *at all favorably* with the Baldwin and Rogers locomotives he has in use there now (meaning Peru), I will forfeit $5,000 in gold and (he says) I will give him as many orders as he can fill for five years."

This looks amazingly like bunkum, so much so that I think it unnecessary to occupy your valuable space with any more quotations, and will now close this letter with kind regards to Mr. Evans, and thanks to you for its insertion.

I am, Sir, your obedient Servant,
ROBERT F. FAIRLIE.

Standard Rail Sections.

The RAILROAD GAZETTE, published in Chicago, contains in its issue of 15th October last an article contributed under the signature "O. W. B.," animadverting on Mr. C. P. Sandberg's standard rail sections, an account of which appeared in *Engineering* a short time back, and which remarks we cannot allow to pass without some comment. Every one likes his own child best, and therefore it is but natural that "O. W. B." should prove no exception to the rule, especially as he does not seem to be aware that the system he adopts has been tried and found wanting long ago. The article in question, which we reproduce on another page of this number, is illustrated in the original by a standard section of "O. W. B.'s" showing, the fish-plates being in contact with the web of the rail, the angle between the vertical part, or web of the rail, and the head and flange more nearly approaching the horizontal than in Mr. Sandberg's section, while the upper side of the rail head is perfectly flat. As already mentioned, this arrangement was tried many years ago on European railroads, but has now been entirely abandoned, for the reason that after a few years' wear it causes a slack joint, producing a shock to the rolling stock every time it passes over, thereby occasioning a considerable increase in the wear and maintenance of the permanent way. It is no doubt of importance to keep the ends of the rails well together in a horizontal line, but it is of still greater importance that the fish-plates should, if possible, give the same strength to the joint in a vertical direction as the rail possesses in the middle, and that the wear of the cheeks of the fish against the under part of the rail head, as well as the upper side of the flange should be contracted by an arrangement which will allow of the fish being screwed up closer to the web of the rail in proportion as the wear goes on year after year. We are not astonished to learn that the section of the Hudson River Railroad, as recommended by "O. W. B.," has stood "nearly two years satisfactorily; but how will it be in ten years' time, when these fishes are worn off and cannot be tightened? New fish plates will have to be made, allowing a space of, say, 3-10 in. from the web, as shown in Mr. Sandberg's sections. It will then be necessary to make them as thick as possible, for Baron von Weber's experiments, published in our columns, show that sleepers require to be laid with centres 2 ft. apart in the joint, to obtain the same stiffness of rail as in the middle, with three ft. distance between the sleepers. The next fault which "O. W. B." finds with Mr. Sandberg's section is that the underside of the head is not at right angles to the web. In that case, however, the plates would not be reversible, and a different strain would be put on the top and the bottom cheek of the fish, resulting in the very fault "O. W. B." attempts to attach to Mr. Sandberg's rail section, viz., that the fish does "not remain permanently as designed for it;" but how could this happen when the fish is reversible, and has the same strain upon its top as its bottom cheek? Mr. Sandberg has adopted 11° in his section and "O. W. B." proposes to reduce this, for the top part, to a horizontal line. It might be worth his while to consider the desire expressed by rail-makers in the discussion upon Mr. Sandberg's paper, read before the Institution of Civil Engineers two years ago, for a pear-formed rail-head, or a gradual taper from the head to the web, for facility in rolling, and we have before us a similar suggestion by one of the greatest rail-makers in Wales for a better delivery and greater radius in the corner of Mr. Sandberg's section. What, then, would the rail-makers say if required to satisfy "O. W. B." on this point? We believe that Mr. Sandberg has drawn the line at a proper medium, so as to practically meet, at the same time, the requirements of the railway engineer and the capabilities of the rolling mills, and the best proof of this is that the railroad companies in the United States and elsewhere continue to specify very largely for his sections, while makers do not object to them, although they naturally would prefer sections still easier to roll. Again, the flat head of "O. W. B.'s" rail would cause great loss to the makers through many wasters, for want of delivery in the rolls, without any benefit to the railroad companies; for, with a 6 in. radius, as adopted by Mr. Sandberg, the necessary delivery is obtained with so slight a rounding of the head, that, after a short time of wear, it will become as flat as designed by "O. W. B." As to the bolts—which are ⅞ in. diameter, and not 9-16 in. as stated by "O. W. B."—these are shown pear-shaped under the head, which answers the same purpose as the oval proposed, and weakens the fish-plate less. The holes in the rail are made round, for the purpose of being drilled for steel rails, so that the same fastenings may be used for either iron or steel; the holes are made large enough to allow for contraction and expansion.

Thus much in regard to Mr. Sandberg's standard rail sections. Turning to the subject of tests, "O. W. B." approves of his falling test as a security for safety from breakage, but seems to doubt the efficiency of his inspection as to the wearing qualities of the rail. We would only refer in this respect to our article in *Engineering* of August 19, page 139, page 601, Vol I, RAILROAD GAZETTE, on the specification for manufacture and tests of the welding of the rail as well as of the top slab, as adopted by Mr. Sandberg, where it is allowed that different methods may be followed, according to the different qualities of iron in each district, but the rule is laid down that "in either case the slab when broken must show perfect welding;" and having specified for the rail pile and heating and testing, it goes on to say: "The fractures must show perfect welding in the head and in the different wearing parts of the rail." We further gave an outline of the result of careful inspection according to the system pursued by Mr. Sandberg, and have since then had fresh proofs of the efficiency of his labors, not only to secure a safe, but also a durable rail for those American railroad companies which have intrusted him with the important charge of inspecting the manufacture of their rails in this country, and we join with "O. W. B." in the hope that these services may be remunerated as they deserve to be.—*Engineering.*

Scientific Literature.

At no period since the invention of printing were books at once so plentiful and so cheap as at the present time. The divine afflatus would appear to have fallen on thousands, where formerly it visited but a few favored individuals; and a considerable number of the members of the various liberal professions now occupy a portion of their leisure time in writing. It is somewhat to the credit of the age, too, that so large a proportion of this literature is above the level of mediocrity. With regard to that section of literature which deals with the various branches of engineering, there are to be found very many really excellent works, works of sterling value to the profession. There was a period when, from narrow feelings of jealousy, but little really useful practical information could be found in professedly scientific works. Fortunately, matters are changed in this respect, and many writers now try to give their readers the full benefit of their experiences. We say many, we do not say all, as a proportion of writers rather labor to make books—labor to make a good deal of "copy," but yet keep the really valuable part of their experiences to themselves. Many of these writers, if their works are sharply criticised, say that it is unreasonable to expect that they should make public certain valuable knowledge that they have been at much expense of time and labor to get hold of.

One of the prevailing defects in most modern writings is a tendency to verbosity; words are often needlessly multiplied. We believe that there are three causes for this. The first an anxiety to make "a thick book;" the second arises, we fancy, from that feeling of egotism that must in the nature of things exist more or less in the breasts of all book writers—the same feeling that prompts every man, when his own hobby is the subject of conversation, to descant and enlarge thereon; the third reason most probably lies in the anxiety that some writers feel to make themselves understood, and not being perhaps practised at writing cannot explain themselves without a multiplicity of words. This defect in books professedly of an educational nature is one to be regretted, because in the present day, when time is valuable, when also the pupil has so much to learn, knowledge ought to be conveyed to his mind by books or word of mouth, unencumbered with a lot of words and technical expressions not directly bearing on the immediate principle of the case in point. As an illustration of what we mean, we will refer to the contrast between the tales of fiction formerly written by standard authors, such as Sir Walter Scott and Cooper, and those written now-a-days by such writers as Reade or Trollope. There is fifty times the stirring incident in modern novels that there was in Cooper's best productions. We wish something of this principle applied to a considerable section of modern works of science. The scientific writer should guard as far as possible against a multiplicity of figures or the introduction of abstruse formulæ. Were writers to deal more with abstract principles and less with rules, students would have less trouble in mastering the contents of the volumes placed in their hands. There is one point evidently neglected in many books, that is, efficient editing. Some publishers do occasionally attend to this with the manuscripts they undertake to publish, but the practice is by no means universal.

We will state a conviction we have that may very possibly startle our readers. We have an impression that some members of the engineering profession could supply books to the public of a far superior class to very many now published, could such men be but prevailed on to take pen in hand—men who have labored hard at the most practical parts of engineering construction, who know the laws to be observed, the principles to be attended to, the difficulties to be overcome. Such men, however, have not egotism enough to rush into print. They have that contempt for their own acquirements that is begotten of familiarity and consequently do not give others the benefit of their experience from the idea that it is of no value. In scientific literature a remarkable difference is to be noticed between French and English writings; only a portion of the books published in Great Britain are overdone with figures, but a formula to a Frenchman is as the breath of his nostrils. A Frenchman will take out the quantities of an earthwork to six places of decimals, while most clever English contractors will with very few figures, and no fractions, very often make out estimates which, without being unreasonable, will leave them a handsome profit, whereas the Frenchman frequently comes to grief with all his elaboration. We must not be understood to assert that mathematics are of no value—far from it; but we do say that their value is only found by those who can comprehend the broad principles of the science.

Not a few books are published which are excellent in their way, if only a reader had time to devote weeks to their study; except as school books, however, such publications have little value. Where is the scientific man who has time now to sit down and master several pages of figures and mathematical signs to get at a particular point? We even consider it a decided defect of decimals that their use frequently entails the introduction of such a number of figures to deduce a result. Scientific books in the present day require to contain the very essence of the subjects they deal with, and he is a clever writer who can at once condense his information and yet avoid being superficial.

There is one class of scientific literature that still has great vitality, and yet we sometimes wonder whence comes its popularity—we refer to encyclopædias. Who reads them, we wonder? Some persons take much pride in the possession of six, eight, or other number of handsomely bound volumes of the "British" or other work of this class, but it is more than doubtful if they ever study the contents, and yet such works are very expensive and costly to get up.

One other class we must notice, and that is what is generally known as engineers' pocket-books. We do not exactly know the date of the first publication of one of these volumes, but beyond question some of them are really valuable works, and no engineer could conveniently get on without them in the present day. Foremost in the ranks of these books stands without any question Molesworth's invaluable little work—it might almost be styled the engineer's *vade mecum:* it is by far the best pocket book that has ever been published; scarcely any question can present itself that cannot be determined with its assistance. Some other books, also valuable, are brought before the public, but, though possessing many excellent features, are yet inferior to that little volume.

Now that the new year is drawing on it is probable that both writers and publishers are preparing fresh editions of the existing pocket books, and a few remarks on those books as they now stand may not be ill-timed. The leading defects in these books are that much of the data, many of the experiments are very old. Experiments and experiences of Telford and his contemporaries, however valuable in themselves, need to be supplemented by the experiences of our own time. Compare the vast variety of qualities of iron and steel now in use in construction with what Telford and his colleagues had at command; yet no results, no experiments, are noticed in modern pocket-books about the performance of these metals. Then, again, in the evaporative values of fuels, no results of modern practice, no questions of the performance of various coals in modern furnaces or boilers is noticed. This is matter of regret. Even in Molesworth, there are various matters which might be added with advantage; it is somewhat curious in this little book that while it gives elaborate diagrams, figures, and particulars of Prussian railways and rolling stock, it gives but little about English stock. We think it would be a great advantage also if it gave more particulars of the constructive details of rolling stock, the carriages, wagons, &c. A little notice of the results of modern improvements in marine engineering, such as surface condensation, the various forms of screw propeller—all these are points that might be attended to with advantage. The obituary, almanac, and list of members of the various institutes, we think might be cut out of pocket-books with great advantage; what use are such matters in books professedly but the *precis* of modern engineering practice? We could, did our space admit, point out many similar things that authors and publishers would do well to amend. In conclusion we could exhort those who write scientific books to bear in mind that brevity is the soul of wit, and that no writing is so clear or so instructive, as that which is based on simplicity.—*Mechanics' Magazine.*

—An important Russian railroad has recently been opened. The line is from St. Petersburg to Revel, a Baltic port. It is 260 miles long, cuts the Warsaw Railway at Gatchino and the Moscoe road at Tosna, so that freight can be carried to the interior without coming through St. Petersburg, thus saving thirty-three miles. The merchants of Revel expect this road to give them great advantage for the English trade, as their ports are open nearly the whole winter, and they are thus brought 150 miles nearer to Mosco than the port of Riga.

—The Sioux City *Journal* says the Sioux City & Pacific and the Illinois Central Railroad companies are at war. The Illinois Central has refused to allow the Sioux City & Pacific Company to run its trains up and turn on the "Y," and the Sioux City & Pacific, in retaliation, has forbidden the Illinois Central to run over any part of its track; and so the matter rests at present.

General Railroad News.

OLD AND NEW ROADS.

Grand Trunk.

We understand that the Grand Trunk Railway Company are importing an iron ferry boat to run in connection with their road between Fort Erie and Buffalo, and Sarnia and Port Huron. The vessel will be over 300 feet long, 45 feet beam and 14 feet hold, with twin screw power, and will be able to carry a full train of passenger or freight cars with locomotive if necessary. The steamer was constructed at Jarrow-on-Tyne in the yard of Messrs. Palmer & Co., the builders of the iron clads "Triumph" and "Swiftsure," and is expected out at Portland in 8 or 10 days, when she will be taken in charge of by Mr. Thos. Campbell, who is at present in the city awaiting her arrival. The steamer will be built under his superintendence at Fort Erie. Mr. Campbell is well able to construct such a work efficiently, being one of the leading shipbuilders of England. When completed the ferry will be in all probability the largest in America and will increase greatly the company's carrying capabilities.—*Montreal News.*

North Shore of Canada.

A dispatch from Quebec says that an arrangement has been made between the Quebec government and this company by which the company are to receive two millions of acres of wild lands, and are to build the North Shore road to Montreal, including the Piles and St. Jerome railways. The directors of the North Shore shall be twelve; four of whom are to be named by the government. It is also stated that the Canada Central are to receive 10,000 acres per mile, for building their line along the north shore of the Ottawa River to Aylmer.

Central of Iowa.

This company, whose road, now near completion and about to supply the missing section in a great north and south line which will extend from Duluth on the North to St. Louis—and for that matter to New Orleans—on the South, was first organized at Oskaloosa eleven years ago, and Mr. J. B. Grinnell, of Grinnell, was its first president. The town of Grinnell gave $70,000 towards the grading of the line, and it proposes to offer land in order to secure the machine shops.

The Hon. J. B. Grinnell had two miles of the road, approaching Grinnell, graded at his own expense. His generosity has taken a name, for already the railroad men call the stretch "Grinnell's grade."

Vermont Central.

The annual meeting of the first mortgage bondholders was held in Boston on the 30th ult. From the trustee's report, which was submitted by J. Gregory Smith, it appears that the net earnings of the road during the past year were $2,084,884.49, and the net expenses for operating the same, $1,495,907.50, leaving a balance on hand of $588,976.99. The proceeds from bonds and equipment loans were $484,310.08, which added to the above earnings, made the total receipts $2,571,814.58. The disbursements were $2,553,880.61, and the assets $578,588.33.

The increase of earnings over those of last year was $32,029 52, which was an access of $135,454.07 over those of any preceding year. The increased expense caused by the great flood, from which the railroad suffered severely, was $137,810.05, making a reduction in the net earnings of $2,355.98.

The trustees speak in the most satisfactory terms of the increased business of the road. Within the year there has been added to the rolling stock 7 new first-class locomotives, 14 passenger, 7 baggage, 209 box, 166 platform and 20 coal cars. The changeable gauge system in cars has proved of great advantage. The trustees believe that the time has arrived when the road can be advantageously transferred to the corporation with profit to the stockholders.

Mississippi, Ouachita & Red River.

The Camden (Ark.) *Journal* says that the cars are now running on the railroad to within a few hundred yards of Bayou Bartholomew, 16 miles from the Mississippi; and that at the present rate of track laying the road will be completed to Camden by the 1st of August next.

Cairo & Fulton Extension.

The Cedar Rapids (Iowa) *Times* says that George Douglass, of the firm of Douglass, Brown & Co., returned to that place from New York last week, whither he had gone for the purpose of representing his company in bidding for the construction of a railroad in Texas. Mr. D. informs us that the firm of Douglass, Brown, Reynolds & Co. secured the entire contract for the construction of the road. The road connects with the Cairo & Fulton road, and runs diagonally through the entire State of Texas to the Rio Grande, a distance of 600 miles. The company obliges itself to construct seventy-five miles per year. The money involved in this contract will be from twelve to fifteen million dollars.

Keokuk & Minnesota.

It is reported in the Washington (Iowa) *Press* that Guy Welles, of Keokuk, has purchased enough Swede iron to lay 110 miles of the track of the Keokuk & Minnesota Railroad. "It had been shipped to New Orleans for another company, which was not able to fulfil its contract after the iron had been dumped on the levee, and it was bought at $15 per ton less than the usual price, the company owning it agreeing to take the bonds of the Keokuk & Minnesota Railroad at very fair rates."

Chicago & Southwestern.

Last week the construction train reached Floris, Iowa, about thirty miles east of Centreville, and the entire line from Floris to Lineville, forty-two miles southwest of Centreville, a distance of more than 70 miles, was black with men and teams. The number of hands on that part of the work is estimated at 5,000.

Davenport & St. Paul and Iowa Midland.

The opening of these roads to Maquoketa was celebrated last Tuesday by excursions.

Bedford & Bridgeport.

Already there is a struggle for this railroad, which is not yet completed. Arrangements having been made to lease it to the Pittsburgh & Connellsville Railroad, a preliminary injunction was obtained by Wood, Morrell & Co., who claimed to hold $150,000. Another suit has been brought by the Pittsburgh & Connellsville Company asking that this Wood, Morrell & Co.'s subscription be declared void and that the lease be declared valid.

Atchison, Topeka & Santa Fe.

The Atchison *Champion* says that a contract has been made by parties in that city with this company, by which it is agreed that work shall be commenced on the extension of this line from Topeka, its present northeastern terminus, to Atchison next spring, at Atchison. It is to be completed by the 1st of October following to the south line of Atchison county, about 16 miles, and by the 1st of May, 1872 to Topeka, about 50 miles. The route is to be by way of Grasshopper Falls.

Stevens' Point & Portage.

The survey of this line will be commenced soon from Stevens' Point southward.

West Wisconsin.

The St. Paul *Press* of the 11th says: "At a meeting of some fifty or sixty of our leading business men at the Metropolitan Hotel, on Thursday night, a committee was appointed and empowered to complete arrangements for the immediate completion of the West Wisconsin Railroad to St. Paul. The road will be completed before January 1 to within thirty-four miles of Hudson, and to Hudson by July 1, 1871. All the iron has been purchased to complete the road to that point. It has been determined that the St. Paul, Stillwater & Taylor's Falls road shall be completed to Hudson by that time. The preliminary surveys are already in progress, and it is believed that a feasible line may be found not more than eighteen miles long from St. Paul to Hudson. One of a little over nineteen miles, with easy grades, has already been surveyed. It has already been stated that an agreement has been entered into between the West Wisconsin and Chicago & Northwestern, whereby the link necessary to connect these roads between Madison and Tomah is to be completed simultaneously with the completion of the road to St. Paul, and whereby the cars of both roads are to pass without change between Chicago & St. Paul. This will bring St. Paul within 380 miles of Chicago, by one of the best best-built railways in the country. It is confidently believed and promised that the time between Chicago and St. Paul will be reduced on this route to twelve hours." The construction of a line from Hudson to Stillwater will enable cars to pass from the West Wisconsin to the Lake Superior & Mississippi without passing through St. Paul, which will doubtless be convenient for through freight between Duluth and Chicago.

Burlington & Southwestern.

The Keokuk, Iowa, *Gate City* of the 12th says: "Track-laying on the Burlington & Southwestern Railroad was stopped a week ago on account of the non-arrival on time of a 'Howe Truss' bridge contracted for in Chicago. Yesterday the bridge arrived, and will be raised by the middle of the week, when track-laying will soon be resumed, and there will be no more delay until the Des Moines river is reached. We understand that financial arrangements have been concluded that will insure the building of the line to the North Missouri road very early next summer. The point of junction is not yet fully determined, but will most likely be at Bloomfield. The track will be laid to Farmington early in January."

Nebraska Trunk Railroad.

The Plattsmouth (Neb.) *Herald* has authority for saying that "Mr. J. F. Joy has made a written proposition for building the Trunk Railroad through from the State line—to which point he has already contracted to build—to Plattsmouth, and to have the cars running into this city before the 1st day of January, 1872. Mr. Joy will ask aid of the different counties, either in precinct or county bonds."

The Iowa Shops of the Illinois Central.

The locomotive shops of the Iowa Division of the Illinois Central Railroad were formerly located at Dubuque. It was found convenient to remove these further west in order to accommodate all parts of the line which now extends more than 300 miles west of Dubuque. Waterloo, a station 73 miles west of Dubuque and within two or three miles of the junction of the Cedar Valley Branch which is now 75½ miles long and is likely to be extended to St. Paul, offered 70 acres of land and $23,000 to secure these shops, and its offer was accepted. The shops which have been constructed at Waterloo and have been occupied about a month are described as follows by the Dubuque *Herald*:

The buildings of the Waterloo shops consist of a round house with 14 stalls for engines, machine and blacksmith shops 245x60, and carpenter and paint shops 120x42. These buildings are constructed of brick from Dubuque, and are as nearly fire proof as it was practicable to make them. The Central company, in erecting them and improving the machinery, has already expended $45,000, and it is said has but just made a beginning.

The machinery is of the best character. An engine of forty horse power drives it. There are ten engine lathes, four drill presses, three planers, a shaping machine, a boring mill, a large lathe for turning driving wheels, and a transfer table for placing engines in the machine shop, five of which can be accommodated at once. In the blacksmithing department there are fourteen forges, and a trip hammer. In addition to this large machinery there is, of course, a full complement of hand tools in all of the departments.

Mr. Thomas W. Place, who in 1857 was engineer of the first train which ran on the Dubuque & Sioux City road, is Master Mechanic of the Iowa Division, and has charge of these shops. Charles Kuehnle is foreman in the machine shop, C. H. Remington of the round-house, Jacob Drill of the blacksmith shop, H. J. F. Small of the carpenter shop, George P. Turnier of the paint shop, William M'Millan of the boiler shop, and Charles Strongen of the tin shop. O. Reynolds is bookkeeper, and G. A. Burns timekeeper. At Dubuque John H. Pollard is foreman of the round-house and George B. Smith is foreman of the car shops, which are not to be removed, Dubuque being found most conveniently located for car repairs. The Waterloo shops now employ about 125 men, the Dubuque car shops about 50.

American Locomotives for Brazil.

Speaking of the Baldwin Locomotive Works, a description of which we published lately, the Philadelphia *Ledger* says: "Rather more than one locomotive is completed and sent out for every day in the year, to supply the wants of railroads in every part of the United States and portions of Europe. Three locomotives, one nearly completed, are intended for the Don Pedro Railroad, in Brazil. Each of them weighs 90,000 pounds, being the heaviest locomotives yet constructed. They are to be used as freight engines, and on a road with heavy mountain grades. This firm are also constructing small mining locomotives, that weigh but 14,000 pounds, and are to be used in place of mule power, in hauling coal from the head of mines. They are five feet high and five feet broad."

Gilman, Clinton & Springfield.

We learn from the Springfield *State Journal* that the grading of this road is very nearly completed and that 1,000 tons of rails have been delivered at Gilman and will be laid this winter. A contract has been made for rails sufficient for the whole line, which is to be completed as soon as possible. The road, it is understood, will be operated as a part of the Pennsylvania company's system.

Chicago & Rock River.

The work on this road was commenced last summer, but was not continued according to contract. Now, we learn from the Amboy *Journal*, work is going on rapidly, five miles east of Amboy is graded, men are at work on the west end (Rock Falls) and it is hoped that the line between these two places will be ready for the iron by Christmas. There is a report that the road will connect with the Chicago & Iowa Railroad near Shabbona's Grove and form with it nearly an air line from Rock Falls to Chicago. With this and the Mendota & Prophetstown and the Chicago & Iowa, the Chicago, Burlington & Quincy company will have a grid-iron pretty much all over that part of the State

south of the Northwestern and west of the Illinois. river.

Jackson, Lansing & Saginaw.

Mr. Chandler has introduced a bill into the Senate authorizing this company to change its northern terminus from Grand Traverse Bay to the Straits of Mackinaw without forfeiting its land grant.

Ottawa, Oswego & Fox River Valley.

A telegram from Ottawa says that the stone work of the bridge across Fox River, thirteen miles north of Ottawa, on the Ottawa, Oswego & Fox River Valley Railroad, was completed on the 8th inst., and the superstruction was delivered on the ground the next day. It is expected that the bridge will be ready for crossing within a week. As the track is laid the entire distance between Aurora and Streator, when this bridge shall have been completed, the road between these points will be ready for the cars, and regular passenger and freight trains will commence to run.

Rutland Railroad.

This company has leased that portion of the Vermont & Massachusetts between Brattleboro, Vt., and Grout's Corners, Mass., 21 miles, on the following terms: For the first five years the lessees pay the sum of $42,000 per annum; for the next five, $48,000; for the last five, $54,000. Bo this arrangement the Rutland Railroad obtains control of an unbroken line from Burlington, Vt., to Grout's Corners, a distance of 165 miles, besides upwards of sixty miles additional connecting with its steamboat line at Plattsburg. The entire line, rail and water, controlled by this company comprises about 250 miles, being a greater distance than is controlled by any other New England corporation, with one exception.

Hartford & New Haven.

The branch of this road from Windsor Locks to Suffield was opened for business on the 12th inst.

Portage, Stevens' Point & Superior.

The Portage (Wis.) *Register* says:

"In our last number we gave the details of the organization of the Portage, Stevens' Point & Superior Railroad Company. On Tuesday last, Hon. George Reed, President of the Land Grant Company for building the road to Lake Superior, was here to arrange terms of consolidation between the two companies. After a lengthy conference between Mr. Reed and Mr. Corning, the presidents of the companies, terms were agreed upon and executed, subject to a ratification by the directors of the company of which Mr. Corning is President. The terms agreed upon are substantially as follows: The Portage, Winnebago & Superior Railroad agree to commence forthwith, and complete within ninety days, a survey of the line between Portage and Stevens' Point, on the most direct feasible route. within one year from the 1st day of June next the grading is to be completed, and within two years from the present time the track is to be laid over the entire line of road. Any failure on the part of the company to perform their part of the contract makes a forfeiture of their rights, and the Portage & Superior Railroad Company may resume control of the route, on paying a reasonable amount for the work which may have been performed on the line, excepting the cost of the survey."

Monticello & Port Jervis.

The grading, masonry, and bridging are finised, and the iron laid to Hartwood, or nearly two-thirds of the entire length of the road. It will be opened for business by the 1st of January, 1871. The road terminates at Monticello, the county seat of Sullivan county.

A. T. Stewart's Railroad.

On the 3d inst. a contract was awarded to Patrick H. Shields for buiding the portion between Farmingdale and Queens, nine miles. It is to have a double track, and to be completed by April. At Queens it will connect with the Long Island road. Two routes from this point to New York city have been surveyed. One is north and northwest through Flushing, Newtown, and Astoria, with a ferry-landing at fiftieth street. The other is south and southeast to Valley Stream, intersecting the South-Side Railroad, and connecting at Bay Ridge with the Hempstead Plains & Bay Ridge road. Seven miles of it are now in running order.

Quincy & Carthage.

This railroad is now completed, the last rail being laid last Wednesday. It is 40 miles long and in connection with the Carthage & Burlington Branch of the Chicago, Burlington & Quincy (which operates the new road) gives a direct line from Quincy to Burlington.

St Louis & Cedar Rapids.

The section of this road completed is from Bloomfield, Iowa, north to Ottumwa, 20 miles, which is operated by the North Missouri Railroad Company. This company refuses to undertake the extension of the road from Ottumwa to Cedar Rapids, but Mr. Wm. McPherson, its financial manager, offers to provide money for this purpose if a valid subscription of $2,500 per mile and the right of way are secured. The Sigourney *News* says that there is little doubt that the required subscriptions will be made.

Chicago & Michigan Lake Shore.

Track laying is in progress north of St. Joseph at Garnett, and the grading is completed through Manlius nearly to Holland. Iron is brought over the Kalamazoo & South Haven road to Garnett, whence track laying is progressing southward.

Green Bay & Lake Pepin.

The Green Bay (Wis.) *Advocate* says the whole of the Green Bay & Lake Pepin Railroad, from there to the Wolf River, with the exception of a few rods occasionally, is now complete and ready for the iron. Beyond the Wolf, Messrs. Call & Farnsworth are pushing the grade with two or three hundred men, across the four miles of low ground liable to be overflowed in the spring.

Louisville & Nashville.

The track of the Lebanon Branch of this road has been extended from Mount Vernon to Big Rockcastle River, eleven miles, since June.

Frederick & Pennsylvania.

The iron for this railroad which will form an extension of the Hanover Branch Railroad of Pennsylvania across Marylaud to the Potomac, has been purchaced, and the road is to be completed as far as Taneytown by the end of this month.

Cincinnati & Springfield Short Line.

The New York *Bulletin* says: "This enterprise has finally settled down in the following shape: The Cincinnati, Sandusky & Cleveland Company will perpetually lease its track from Springfield to Dayton to the Cincinnati & Springfield Railway Company. The track from Dayton is not yet located. The Cincinnati, Sandusky & Cleveland Company will run its trains for the Short Line to Dayton and Cincinnati, but its shops and headquarters will probably be located in Springfield. The Cleveland, Columbus, Cincinnati & Indianapolis Company will run its trains to Cincinnati by way of Delaware, Springfield and Dayton, over the Short Line, instead of by way of Columbus, as heretofore. The Columbus, Springfield & Cincinnati road will be completed at an early day, and trains will run to Cincinnati *via* London, Springfield and Dayton."

Cumberland Valley.

The President in his late annual report says: "The second track between Bridgeport and Mechanicsburg, a distance of eight miles, will be completed the present season; new passenger station-houses bave been built at Bridgeport and Hagerstown; the grading of the extension, from Hagerstown to the Potomac, is about completed; the work on the Southern Pennsylvania Railroad is about one-half done, and will be completed by the 1st of April next; its length is 25 miles. One hundred and fifty tons of steel rails have been purchased and about 800 tons more will be required during the next year. Two more additional passenger cars will be built."

Port Huron & Lake Michigan.

The annual meeting of this company was held at Port Huron on the 1st inst. The annual report shows that there are 42 miles of iron laid and 38 in operation, and the road will be completed to Lapeer before the close of 1870. Had not the contractors for iron and other materials failed, 20 additional miles would have been built. Station grounds and buildings have been provided this year at the Grand Trunk crossing, Capac and Imlay, 3,000 feet of side track, and 1,090 feet of dock at Port Huron. The road was opened for traffic to Capac June 8, and Imlay city July 28. The gross receipts have have been $41,259; number of passengers carried, 16,657; freight, 17,866 tons; running expenses, $22,315. The following officers were chosen for the ensuing year:

President, Edgar White; Secretary and Treasurer, W. L. Bancroft; Directors, E. White, W. L. Bancroft, Port Huron; James Terrill, Lapeer; Artemus Thayer, Flint; Isaac Gale, Burlington; W. F. Allen, Albany, N. Y.; N. F. Drake, New York city.

Burlington, Cedar Rapids & Minnesota.

The preliminary surveying party has reached Blue Earth City, Minn. The distances over the line already built, and to be built, are as follows:

Burlington to Cedar Rapids	98 miles.
Cedar Rapids to Cedar Falls	60 "
Cedar Falls to Mason City	60 "
Mason City to Forest ity	25 "
Forest City to the State Line	20 "
State Line to Blue Earth ity	15 "
Total	278 miles.

Chicago, Danville & Vincennes.

This road is now completed to very near Watseka, Iroquois county, Ill., and it is expected will be finished to Danville within the next half year.

Great Western of Canada.

Traffic on the branch from Hamilton to Toronto is to be suspended to-day, in order to give time for the change to the 4 ft. 8½ in. gauge, which will be the gauge of the entire line.

Terre Haute & Danville.

The track is laid from Terre Haute to Newport, about twenty-five miles, and will probably reach Perryville, twelve miles farther north, before work closes for the winter.

Laclede & Fort Scott.

The contract for graduation and masonry of about 16 miles of this line from Nevada City, Mo., east to the west line of Cedar county, has been let to Messrs. Attaway & White, of Lebanon, Mo. All the work between Fort Scott and Lebanon is now under contract or completed, except the part of the road lying in Cedar county. It is the intention of the company to begin work in Cedar county at an early day.

Plymouth, Kankakee & Pacific.

This company has completed seventy miles of grading between the State line of Indiana and Bureau Junction, Ill. Piers and abutments for four bridges, including that across the Kankakee river at Kankakee City, are completed, and are in process of construction across the Mazon, across the Vermillion at Streator, and the Illinois, near Bureau Junction. The President is authorized to put the grading from the State line to Ptymouth, Ind., under contract immediately. The company has a contract with Albert W. Barnes & Co. for ironing their road.

Fort Wayne & Pacific.

Allen county, Ind., voted, last Tuesday, on a proposition to subscribe $200,000 in aid of this proposed road. Fort Wayne, the county seat, voted in favor of it by a majority of about eleven hundred, but it was defeated by about 200 majority in the county. This is second time the county has overcome the city's large majority for a railroad subsidy.

Minneapolis & White Bear Lake.

It is announced that this road is soon to be put under contract, to be completed by July, 1871, when it will be leased to the Lake Superior & Mississippi company.

St. Joseph & Denver.

Mr. A. A. Robinson, Resident Engineer of the company writes us that:

"It is intended to intersect the Union Pacific Railroad at or near Fort Kearney on the Platte River. Twenty miles of this road were put under contract on the first of March last, and fifty miles, reaching to Marysville, on the first of May. Cars are now running over sixty miles of this contract. The remaining ten miles are graded and the track will be laid in a few days. The company have now in operation one hundred miles of line."

The Delinquent Tennessee Railroads.

The Commissioners appointed by the last Tennessee Legislature to effect the sale of delinquent railroads in Tennessee, submitted their report on the 14th inst. The report, which is elaborate, urges the immediate filing of a bill, in the Chancery Court at Nashville, against all the delinquents, and that said court have exclusive jurisdiction of all matters of dispute, to be determined before the decree of sale, all delinquent roads to be sold on one, two and three years' time, 25 per cent. to be paid in hand. A bill in conformity with the report was also submitted and passed the first reading in the Senate. It is believed that the bill will certainly pass both Houses without material modification. The commissioners are Hons. R. J. McKinney, Archibald Wright, and F. B. Fogg, the two first named ex-Judges of the Supreme Court, together with Governor, Secretary of State, and Comptroller.

TRAFFIC AND EARNINGS.

The earnings of the Central Pacific Railroad Company:

For November were	$761,690
For November 1869 were	535,366
Increase	$226,234
From Jan. 1st to Dec. 1st, this year are	$7,417,217
" " " " " last year were	5,260,882
Increase this year	$2,156,435

—The gross earnings for the completed portion of the Pittsburgh & Connellsville Railroad for the year ending September 30, 1870, were $655,736.11; the operating expenses, $469,887.60; the net earnings, $185,848.51.

—It is reported that Hugh Allan, of Montreal, has purchased the steamers of the Northern Transportation Company, and will run them between Chicago, Milwaukee and Montreal in connection with his ocean steamsteamers, giving through bills of lading to British markets, with freights so low that it is believed that trade will be largely devoted to this route.

RAILROAD GAZETTE

PUBLISHED EVERY SATURDAY.

CONTENTS.

	Page.
ILLUSTRATIONS.	
Chicago, Rock Island & Pacific Shops	265
Locomotive Driving Box	265
Car Axles	267
Permanent Way	268
CONTRIBUTIONS.	
Englewood Shops of the Chicago, Rock Island & Pacific Railroad	265
The Warming and Ventilation of Cars	265
Painted Connecting Rods	267
Proposed Improvement in Car Wheels and Axles	267
SELECTIONS.	
Baron von Weber's Experiment on Permanent Way	268
Locomotive Performances	269
Rating Steam Engines	269
Mr. Fairlie's Reply to Mr Evans	270
Standard Rail Sections	271
Scientific Literature	271
Master Mechanics' Association	276
GENERAL RAILROAD NEWS.	
Old and New Roads	272
Traffic and Earnings	273
Elections and Appointments	277
Locomotive Statistics	277
Register of Earnings	275
EDITORIALS.	
The West Wisconsin Railway	274
The Pennsylvania Railroad Company and New York	274
The Third Annual Report of the American Railway Master Mechanics' Association	274
The Central Pacific and the East	275
A Years' Work by the Chicago & Alton Railroad Company	275
The General Ticket Agents' Association	275
NEW PUBLICATIONS	275
PUBLISHERS' ANNOUNCEMENTS	278

Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, *if not previously published,* FREE OF CHARGE. *They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.*

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent

Change in Rates.—On and after the 1st of January next, the price of subscription will be four dollars per year. Until that time, subscriptions will be received for periods not exceeding one year at the old rate—three dollars per year.

Removal.—About the tenth of January next the office of the Railroad Gazette will be removed to Nos. 110 *and* 112 *Madison Street.*

☞ *Our Prospectus and Business Notices will be found on the last page.*

THE WEST WISCONSIN RAILWAY.

A Milwaukee paper has been informed that "it is currently reported in railroad circles and that the report is well founded" that the Chicago & Northwestern Railway Company has gained control of the West Wisconsin Railway. This report we heard several months ago, and though we cannot say that it is well founded, the acts of the several parties concerned indicate that it is. The Milwaukee & St. Paul Company would not have given it up if it had not passed entirely beyond its reach, and the Northwestern is the only other company which could use the road to advantage and which could make a strong effort to obtain it. However this may be, if we may trust the Milwaukee reports the Milwaukee & St. Paul Company have lost the opportunity to obtain the road. We cannot but regard this as a very serious loss. Heretofore that company has commanded the approaches to Minnesota from Lake Michigan. We cannot reach Minnesota by rail from Chicago any more than from Milwaukee without traveling for at least a part of the way over the Milwaukee & St. Paul Railway. The Illinois Central can take us within a stone's throw of its southern boundary, but the most direct route is for more than three-fourths of the distance over the Milwaukee & St. Paul Railway.

For some time it has been certain that it would have a rival for the Chicago business, or rather that its Chicago rival would have a road of its own, which would make it unnecessary for it to send its business over the Milwaukee road, as it is doing now.

This line was to be, and we suppose is to be, by way of Madison by the old line, thence to La Crosse by the Baraboo Air Line, now in course of construction, to Winona by the "Eastern Connection," now nearly completed, and to St. Paul by the St. Paul & Chicago Railroad, of which forty miles or more are in operation, and a large part of the rest under way. By this route the distance to Chicago will be less than is the distance to Milwaukee by the present route. Thus the advantage which Milwaukee possessed was likely to be transferred to Chicago. To prevent this and also to prevent the loss of part of its present Milwaukee business by its transfer to Chicago, as well as the loss of the largest part of its Chicago business, which the Northwestern is preparing to take, it would have seemed wise for it to look for some improvement of its present not very direct route from Milwaukee to St. Paul. The West Wisconsin Railway, then well under way, seemed to offer just the advantages that were wanted. It would, in connection with the LaCrosse line of the Milwaukee & St. Paul Railway, form a route between Milwaukee and St. Paul only 323 miles long, which is 83 miles shorter than the present route by way of Prairie du Chien. With this Milwaukee would still have considerable advantage over Chicago in distance to St. Paul, and would probably be able to maintain its present importance as the lake harbor of Minnesota.

In losing it there is lost, besides a short through line, an important local line; for the West Wisconsin has on its line some of the finest farming country in the West, and for the thirty miles or so where the soil is not fertile there is a fine timber country and a large manufacture of pine lumber. Moreover it has no rival for a day's journey on either side, for most of the distance, and no immediate prospect of any. The traffic of this country will be valuable as well as large.

The Milwaukee & St. Paul Company, it is understood, has foreseen the loss of the Chicago and Minnesota business, which it has hitherto received from the Northwestern, and has taken steps to provide against it by the construction of a new line from some point west of Milwaukee to Chicago. Thus it could compete with the Northwestern's line, and if it should have a connection with the West Wisconsin its line would be very nearly and perhaps quite as short as its rivals. But if it must use its old line to St. Paul, it will have considerably the longest line, and the consequent disadvantage.

There now remain three ways for the Milwaukee & St. Paul Company to secure a shorter route to St. Paul. It may construct a new road; it may form a connection with the Southern Minnesota and run trains to St. Paul by way of La Crosse and Ramsey, by which, however, it would save but six miles; or it may (if the Northwestern has not yet secured permanent control of it) make a connection with the St. Paul & Chicago road by constructing a short line from La Crosse to Winona. The latter course, if practicable, would be much the most advantageous. It would give a line but a little longer than that by way of Tomah, and a very favorable one. Whether it is practicable we cannot say. It was understood that the St. Paul & Chicago Company intended to afford the Northwestern a connection to St. Paul, but we do not know that the latter company has any exclusive contract for the use or possession of the river line. If it has not we may expect the Milwaukee Company to use its utmost endeavors to prevent the making of such a contract in the future, and secure the line or the use of it for itself.

THE PENNSYLVANIA RAILROAD COMPANY AND NEW YORK.

In some respect the great system of railroads controlled by the Pennsylvania Company, which reaches New Orleans in the South, Denver in the West and Duluth in the North, has suffered from the same defect as that of the "Joy" roads: it has had no independent outlet to New York. It is true that circumstances have made this defect less important, for not only is the New York & Philadelphia Railroad a short one, but its operations are confined entirely to New Jersey, and it has sought for no extensions beyond the Delaware. Thus it has been ready to transport traffic for any and all parties who might bring it to its line, obstinately and successfully opposing the establishment of any rival in New Jersey, and as obstinately refusing to become the rival of any line outside of that State. So, if its requirements were somewhat burdensome to the Pennsylvania Company, they were no more so than they were to all other companies.

But whenever there has been competition between the great lines from New York to the West, the New Jersey Company, which shared all the advantages of the traffic over the Pennsylvania Railroad to New York, has refused to bear any part of the labor or expense of securing it. When rates were reduced to non-paying prices, the New Jersey Company has insisted on receiving its regular prices, and the dependent position of the Pennsylvania Company has compelled it to accede to its demands. The immense business which the Pennsylvania Company has brought to the New Jersey road at Philadelphia, has not been obtained without effort and expense. Agencies all over the Union, a costly system of advertising, favors to shippers and others who might influence traffic, have had much to do in attracting this immense business, and the entire expense has been borne by the Pennsylvania Company. The New Jersey Company has quietly taken the traffic and—its pay for carrying it.

Last spring, when there was a contest as to the capacity of the different lines for speed, and the Pennsylvania Company deemed it necessary to run a train between New York and Boston at the fastest rate possible, the New Jersey Company, which, by reason of its low grades, straight line, and perfect track, is able to make as fast time as any line in America, refused to change its schedule for this fast train, and required three hours and quarter for the ninety miles between Philadelphia and New York for a train which came over the mountains from Pittsburgh to Philadelphia at a more rapid rate. Yet this company shared whatever advantage was to be gained by this fast train. So it has been continually. Whatever advantage was to be gained for both roads, the Pennsylvania has been compelled to pay for.

This dependence for a New York outlet has led the lines through New York to assume an advantage over the Pennsylvania route in all negotiations between them. When the observance of certain conditions was proposed, and the Pennsylvania has accepted them for itself, but has said that it could not bind the New Jersey road, Commodore Vanderbilt would say, "Then you haven't got a line."

It is reasonable to suppose that the Pennsylvania Company has not been contented with the situation. But it was by no means easy to improve it. An outlet further north, by the "Allentown Line," may have been within its reach, but to use this it must turn its through traffic from its main line 109 miles west of Philadelphia, and in so doing take business away from instead of through Philadelphia, which it was built to serve, and which is a part owner of the railroad and chooses three of the directors, while sixteen out of seventeen of its directors are residents of that city and many of them intimately interested in its prosperity, To obtain the New York & Philadelphia road seemed well nigh impossible. It is the property of the "United Companies of New Jersey," which own besides, the old Camden & Amboy Railroad, and five shorter New Jersey roads, having a mileage altogether of 165 miles. They have a controlling interest in fourteen other New Jersey railroads, from 2½ to 69 miles long, having in the aggregate a mileage of 260 miles. They lease two other railroads with a total length of 31 miles. They own also the Delaware & Raritan Canal, 65 miles long, one of the great coal carriers of New Jersey. They operate 446 miles of railroad line, 106 of which has a double track. At the end of last year its property represented a capital of $33,693,694.81. On the stock, amounting to more than $17,000,000, it has usually paid 5 per cent. dividends semi-annually.

It is now reported that the Pennsylvania Company has leased this property and will operate it in connection with its other lines. Reports of this kind are not to be accepted on mere rumor, but in this case there are circumstances which make it at least probable that the report is true. The Pennsylvania Company has been making a general and minute examination of the property such as would enable it to understand its value and bargain for it intelligently. According to the report published in New York the Pennsylvania Co. is to have a permanent lease of all the lines owned by the United Companies at a rental of $4,000,000, which is ten per cent. upon a valuation of $40,000,000. This is a very large sum to pay, but considering the improvements which the United Companies have been able to make while paying ten per cent. dividends, it is perhaps not in excess of the earnings of the property heretofore, while there is very little doubt that the Pennsylvania Company with its thousands of miles of road in the West and South can use the property to greater advantage than its present owners.

The Third Annual Report of the American Railway Master Mechanics' Association.

We have received through the kindness of Mr. Dodge, the Secretary of this Association, a copy of its third annual report. It is very much larger than its predecessors, and contains the report of the committees in full, all of which we intend to publish in full, or else give a careful abstract of them. This week we publish

the report on cylinder and stuffing-box packing, and the discussion thereon. It will be seen that there was a great variety of opinions expressed on the subject of steam packing. It is one of those questions which are so entirely dependent upon experience, and so little a matter of theory, that all we can do is simply give our readers the facts as communicated to the association by the report, and the subsequent discussion thereon. Much difference of opinion was expressed, and it is extremely difficult to come to any definite conclusion in a subject, when, as in this case, twenty-one witnesses testify in favor of one thing, and twenty-one in favor of another. One point however is worthy of notice. Several persons who took part in the discussion said that the old-fashioned spring packing for locomotive cylinders gave the best results; others that they found steam packing the best, and others still that packing which was set out without the pressure of either springs or steam was the best. Probably the testimony of all these witnesses is true, and that each one of the different kinds of packing will give good results if properly fitted into the cylinders and to the pistons. If this is so, the question naturally arises, why use either springs or steam to expand the packing rings if neither is necessary? Springs are expensive and *extremely* liable to be set out too tight by careless engineers or other persons. Steam also costs money, and its waste is therefore a loss. It is also impossible for any one to tell the amount of pressure of the steam in the packing rings. Some of the designers of steam packing, we know, are ready to calculate the exact size of the holes for the steam, and their precise number in order to bring any desired pressure on the rigs. But their "calculations" must be mere guess work. On the other hand, from the discussion we learn that rings fitted to pistons without either steam or springs give very good results and are preferred by some to all other kinds of packing. If what they say is true, and there is no reason for doubting it, why not discard both springs and steam, and take the simpler and less expensive "plain rings."

Different men testified that both spring and steam packing worked badly if badly fitted up. Doubtless this is also true of the plain rings. All that it is necessary to establish is, that the latter work well when well made, and their simplicity and cheapness will decide in the case in their favor.

A Year's Work by the Chicago & Alton Railroad.

The fiscal year of this company closes with this month. We have received from the general office an approximate account of the business of the year, which can be very little changed during the remaining days of the year. The statement is as follows:

Gross earnings, 1870, (estimated)	$4,800,000 00
Increase over earnings of 1869	120,000 00
Aggregate tonnage	2,416,000,000 lbs.
Increase over 1869	456,000,000 lbs.
Additional road purchased and constructed during the year (from Dwight to Washington and Lacon)	82 miles.
Thirty-five miles of this line have been operated since March 15, 1870. The balance of the line (47 miles) will be in operation by December 31, 1870.	
Length of line graded, bridged and tied (from Louisiana, Mo., to Mexico, Mo)	51 miles.
Partially graded and bridged (from Roodhouse, Ill., to Louisiana, Mo.)	37 miles.
This line, from Roodhouse, Ill, to Mexico, Mo., will be in operation by July 1st, 1871.	

ADDITIONS TO CARS.

First-class passenger coaches	5
House cars	155
Coal cars	60

While the increase in earnings is moderate, (2½ per cent.). the increase in tonnage is about 23 per cent., showing that the increase of earnings has been made in spite of reduced rates. There has been an unusual competition for through business throughout the year, and a larger share than usual of the travel between St. Louis and the East has gone by the southern routes; yet every new road which has taken business away from it seems to have brought more than it took away.

The increase in mileage of road operated by the company is nearly 20 per cent., and in the mileage owned more than 29 per cent. The 82 miles acquired are the line from Dwight to Wenona, purchased, and from Wenona to Washington, constructed, and the branch of the latter to Lacon, on which the last rail was laid this week.

But the great work of extension is the preparation for a Missouri and Kansas line by the acquisition of the Louisiana & Mississippi River Railroad, and the commencement of a connection with that road from Roodhouse to Louisiana. The latter is now partly graded and will be ready for the iron so that it can be completed as soon as spring opens and be used in forwarding material for the construction of the Missouri line, which is to be completed for 51 miles by next July. The importance of this acquisition it is not easy to exaggerate. It will give access to districts quite as extensive and quite as fertile as the territory now served by the Chicago & Alton road, besides affording most important connections to the Southwest.

The increase in rolling stock is more considerable than might be thought from the figures. It is equivalent to an addition of 12 per cent. to the passenger coaches, 14 per cent. to the house cars, and 10 per cent. to the platform cars.

This road is one of the few important lines in the West which remains entirely independent of Eastern lines. Most other roads have some connection (apparently not very close in some cases)with the Joy interest, the Vanderbuilt interest, or the Pennsylvania interest. The Chicago & Alton, one of the most valuable properties in the West, has no such entangling alliances.

The Central Pacific and the East.

There has been a report of late that the Central Pacific Railroad Company has purchased the Utah Central Railroad (Ogden to Salt Lake City) and that it will extend it from Salt Lake City by a route considerably south of that of the Union Pacific to a connection with the Kansas Pacific at or near Denver.

Whether there is any truth in this report, we do not know; but it is not easy to see what advantage would be gained by the Central Pacific by such a course. The new road across the mountains would, of course, be very costly, as the distance is about 350 miles and for a large part of the way over mountains. This new line would have very little local traffic, and its advantage, if any, would be in affording improved connections. It is reasonable to believe that the Central Pacific would do something in order to prevent the diversion of the Kansas Pacific business to some other line. But the Kansas Pacific, as we understand, maintains its purpose to construct as early as practicable its southern line, and if it should push through Colorado and into the Utah valley, it still would give its traffic to the Central Pacific. If the Central Pacific could prevent the construction of the southern line by such a movement, there would be some reason for it; but even if the Kansas Pacific gives this up, it is likely to be carried out within a few years by some of the many companies who purpose to construct roads from points further south than the Kansas Pacific.

The General Ticket Agents' Association.

In accordance with a notice issued by the Secretary a special meeting of the General Ticket Agents' Association was held in Cleveland this week, commencing Tuesday morning. The object of the meeting was to adjust rates and divisions to the advancee through rates lately adopted. Mr. A. A. Barnes, the President, being absent, Mr. C. E. Follett, of the Ohio & Mississippi, took the chair.

The members present Tuesday morning were the following:

Charles E. Follett, Ohio & Mississippi.
F. R. Myers, Pittsburgh, Fort Wayne & Chicago.
W. L. O'Brien, Pittsburgh, Cincinnati & St. Louis.
J. W. Pillsbury, Marietta & Cincinnati.
P. B. Groat, Hannibal & St. Joseph.
D. M. Boyd, Jr., Pennsylvania Central.
S. E. Carey, Jeffersonville, Madison & Indianapolis.
J. Ferrier, United States Mail Line.
J. U. Parsons, Toledo, Wabash & Western.
W. H. King, Louisville & Nashville.
Edward S. Young, Northern Central.
C. H. Kendrick, New York Central & Hudson River.
William R. Barr, Erie.
C. D. Whitcomb, Michigan Central.
J. McCarty, Indianapolis, Peoria & Bloomington.
Samuel Powell, Chicago, Burlington & Quincy.
France Chandler, St. Louis, Vandalia, Terre Haute & Indianapolis.
W. P. Johnson, Illinois Central.
Beverly R. Keim, Union Pacific.
N. M. Johnson, Cincinnati & Indianapolis Junction.
J. W. Carey, Lake Shore & Michigan Southern.

NEW PUBLICATIONS.

The Nation.—This journal, which within a few years has acquired an extraordinary influence among thinking men, is doubtless the best example of journalism that America has yet produced. Indeed, we do not know where to find in England or the Continent of Europe its equal in its field—so uniformly able, so independent in its criticisms, so cool and dispassionate, so earnest in the pursuit of truth, so clear and convincing in the exposure of error, so vigorous in the denunciation of shams, and so constant in working for the progress of humanity.

There are many men at this day who will acknowledge their indebtedness to *The Nation* for a large part and, we had almost said, the best part of their education. It has taught them how to think, given them new and clearer views of political and social science, and inspired in them a wholesome respect for facts, for reason and for work, and a no less wholesome contempt for blatherskites and shams.

The fact that this country supports a journal of this kind we consider one of the most favorable signs of the times. Already its influence is manifest where it will be most effectual, that is, in the improved tone and in the independence of other newspapers, which have learned the great secret of its strength—a wide and profound knowledge of facts and the skillful use of them.

The Traveler's Official Railway Guide, for December, is at hand promptly, with a large number of winter time tables of the different railroads of the country, most of which were changed after the November number was issued. It has also new maps of the Lehigh & Susquehanna, the St. Louis, Vandalia, Terre Haute & Indianapolis, and the St. Louis & Iron Mountain roads. The *Official Guide* is now a large octavo of about 340 pages, and contains an enormous amount of matter. This number, like those which preceded it, shows careful editing, excellent arrangement and display of time tables and unusual accuracy.

Van Nostrand's Engineering Magazine, for December, contains no fewer than thirty-two articles, several of them well illustrated. Most of these are from English technical journals, one from the French *Annales des Ponts et Chaussees* (misprinted in the magazine *Annales des Port Chaussees*), and two or three from American journals, among them an article on the "Tractive Power of Locomotives," from THE RAILROAD GAZETTE. No less than ten of these articles are from that admirable English weekly, *Engineering*. Thus, the *Engineering Magazine* gives American engineers of all branches of the profession access to the most valuable articles of the costly foreign periodicals, which otherwise most of them would not see at all.

The articles relating to railroads in this number are Mr Fairlie's paper on the "Gauge for the Railways of the Future;" "Rolling Loads," from *Engineering;* "The Utility of Railways for War Purposes," from the London *Railway News;* Mr. Fell's paper, "On the Application of the Centre Rail System in Brazil;" The RAILROAD GAZETTE article mentioned above; and an article on "Rail-Mending," from *Engineering*, all of which, except the last, have appeared in the RAILROAD GAZETTE.

Vick's Illustrated Catalogue and Floral Guide for 1871. Mr. James Vick, a well-known seedsman of Rochester, N. Y., has for some years published a catalogue of his seeds annually, just as many other seedsmen do; but Mr. Vick's catalogue is something more than a catalogue, it is a work of art—in paper, typography, and illustrations one of the most admirable publications we have seen. The catalogue has 96 octavo pages, of fine tinted paper, crowded with very handsome engravings of flowers, of which there are several hundred in the catalogue. It has, besides, two colored plates representing choice varieties of petunias, and these plates are remarkable examples of printing in colors. Mr. Vick gives several pages of instructions for selecting and cultivating flowers, and the whole work, if printed in larger type, bound and offered for sale for a dollar, would be considered cheap; as it is, Mr. Vick offers to send it for *ten cents* to any one who will send for it. It would be an ornament to any parlor table, and valuable to every one who has a place to plant a flower.

REGISTER OF EARNINGS.

FOR THE MONTH OF NOVEMBER.

Central Pacific (890 miles), 1870	$761,600 00
" " (690 miles), 1869	585,366 00
Increase (42¼ per cent.)	$296,234 00
Union Pacific (1,053 miles) 1869	$837,388 00
" " (1,038 miles) 1870	571,379 00
Decrease (31¾ per cent.)	$266,009 00
North Missouri (476 miles), 1870	$266,836 00
" " (404 miles), 1869	248,888 00
Increase (7¼ per cent.)	$17,993 00
Michigan Central (284 miles), 1870	$453,873 62
" " (284 miles), 1869	448,419 01
Increase (1¼ per cent.)	$5,454 61
Chicago & Alton (465 miles), 1870	$432,493 25
" (431 miles), 1869	397,515 13
Increase (8¾ per cent.)	$34,978 12
Illinois Central (1107½ miles), 1870	$841,990 75
" (932 miles), 1869	814,413 15
Increase (3½ per cent.)	$27,577 60
Milwaukee & St. Paul (825 miles), 1869	$801,195 00
" " (936 miles), 1870	791,014 00
Decrease (1¼ per cent.)	$10,181 00
Marietta & Cincinnati (251 miles), 1870	$144,023 00
" " (251 miles), 1869	131,019 00
Increase (10 per cent.)	$13,004 00
Clev., Col., Cin. & Indianapolis (390 miles), 1870	$319,573 00
" " " (390 miles), 1869	273,305 00
Increase (17 per cent.)	$46,268 00
Pacific of Missouri (355 miles), 1870	$321,659 00
" " (355 miles), 1869	298,708 00
Increase (7½ per cent.)	$22,951 00
St. Louis & Iron Mountain (210 miles), 1870	$121,795 00
" " " (210 miles), 1869	80,938 00
Increase (50½ per cent)	$40,857 00
Toledo, Wabash & Western (585 miles), 1870	$425,687 00
" " " (522 miles), 1869	323,377 00
Increase (31½ per cent.)	$102,310 00

FOR THE THIRD WEEK IN NOVEMBER.

Chicago & Alton (465 miles), 1870	$121,339 64
" " (431 miles), 1869	100,824 21
Increase (20⅜ per cent.)	$20,535 43

Two weeks since, the earnings of the third week in October were furnished us by mistake as the earnings of the third week in November.

FOR THE FIRST WEEK IN DECEMBER.

Chicago & Alton (465 miles), 1870	$99,804 58
" " (431 miles), 1869	82,878 94
Increase (20 ⅝ per cent)	$16,925 64

THE MASTER MECHANICS' ASSOCIATION.

Report on Cylinder and Stuffing-Box Packing.

The Committee on Cylinder and Stuffing-box Packing made a report, in which it was stated that reports had been received from twenty-four companies using spring packing, and thirty companies using steam packing. With pressure enough to keep it up to the rings in the cylinder, spring packing is reported to be the most economical. It is also clear that certain kinds of steam packing wear the cylinders very unevenly. Upon the question of the superiority of the two patent steam packings no opinion could be given, as twenty-one master mechanics favored Dunbar's and twenty were in favor of Stevens'. The Chairman of the committee having the casting vote, gave it in favor of the Dunbar packing; but he did so conditionally, as he merely desired to thereby bring the question forward in a more positive shape.

Signed: M. E. Brown, E. R'y.
W. F. Smith, C., C., C. & I. R. R.
N. E. Chapman, C. & P. R. R.

It was moved, seconded and carried that the report be received.

Mr. Brown, E. R'y., raised the question as to whether parties, when stopping up the holes in pistons, actually used steam packing.

Mr. Jackson, R. & W. R. R.—I am surprised to hear of any master mechanic going back from the steam packing to the old-fashioned spring rings. I have had a great deal of experience with different kinds of packing on the road that I am connected with (the Rome & Watertown), for the last seven years. We have adopted Dunbar's packing, and the only trouble I find is that we do not examine it often enough. But when we do we don't know such a thing as having to bore out the cylinders. We have had it in some thirty-six engines on the road, and it works admirably.

Mr. Nesbitt, K. C. R. R.—On the Kentucky Central road we have used Dunbar's packing for over seven years, in all the engines (sixteen in number), and we have never yet had a cylinder cut by it. I measured the cylinder which had the packing longest, and I could not find any difference perceptible in the surface. I think that Dunbar's steam packing is the best.

Mr. Gregg, E. R'y.—I do not suppose we are here to advocate any man's packing, whether Dunbar's, Stevens', or some other man's; but when a packing gives good satisfaction, we have a right, of course, to testify to the fact. I am surprised to hear that any master mechanic having used steam packing, would go back to the old-fashioned spring packing. Not only because it requires more to keep it up, but it also injures the cylinders, and gives extra labor in keeping them in order. I have used Dunbar's packing some considerable time. Some years ago we introduced the packing on our road, and afterwards getting the notion that it did not do very well, we replaced it with Stevens' packing until we had nearly all the engines supplied with it. After all were supplied, we found that this packing was not giving satisfaction. It was wearing the cylinders unequal, and we had to refuse any more Stevens' packing, and replace it with that of Dunbar, and the Dunbar packing is the one we use on the Erie Railroad now. It gives general satisfaction, equally good with any other steam packing that I know of in use.

Mr. Nesbitt—I did not wish to infer that Dunbar's packing was the best packing, but we have used Stevens' alongside of it with the results as stated.

Mr. Wells, J. M. I. R. R.—My experience is that of Mr. Gregg. I have used the Dunbar packing and Stevens packing for some five or six years, and we have found Dunbar's to be the least troublesome. Stevens' packing does very well for a little while, but we were obliged to use small rings more frequently. I have latterly used Dunbar's packing, and we put no holes in it at all. I have several sets running two years, and have experienced no trouble. We seldom take it out, except when the engine is sent to the shop. Sometimes we leave it in a year or eighteen months without removing it. We find it is not necessary to put holes in to allow steam to force it out. There is enough steam that will leak in to keep the small rings out, and consequently it reduces the pressure from what it would be when you put in small holes to allow the full pressure of steam to get under the rings. We have not found this packing to blow through any more than any other in use.

The President—I fully agree with Mr. Wells on the Dunbar packing. For the last four years, on the road with which I am connected, we have used it without any holes. It was perhaps five years last June that I went on the road, and found some engines with the followers and pistons with quarter-inch holes. On the 1st of October, 1865, I closed up the holes in a set of 16-inch cylinder packing. These holes were countersunk and plugged with copper rivets, and the engineers stated repeatedly that they could see a material difference in hauling the train. To-day there is not an engine on the road, with the exception of three, but what has the Dunbar packing, and all holes are closed up, and we use quarter-inch steel wire to set the packing out, and have no trouble from blowing through.

Mr. Towne, H. & St. J. R. R.—We have used both Dunbar's and Stevens' packing for the last five years. We are using more Stevens' packing at the present time than Dunbar. We have found the Stevens packing with a single ring, to do altogether as reported. It wears the bore of the cylinder, and we now use the double ring, one next the follower, the other next to the head, making it wider than the original packing. We have found that the double ring was equal to or better than the Dunbar packing. We use it because it is cheaper, easier fitted, and whenever the cylinders need new packing, we can finish them up in our shops, and send them out ready to be put into any engine on the road. They are a great deal cheaper than the Dunbar packing. We have had to bore only those cylinders in which we used the single ring. Have been using the double ring all last year.

Mr. Cummings, P., F. W. & C. R. R.—I have been using Stevens' packing, and like it. I can make no comparison with the Dunbar packing, for the reason that I never tried but one set. That was put up by Mr. Dunbar into an engine with small rings, but blew out and broke the cylinder, and I have never seen him since. I have used Stevens' packing for seven years, and exclusively for five years. We have put it in one hundred and eighteen engines in that time, and I would say that I think it will compare very favorably with the Spring packing, and is less liable to cut the cylinder. I think why it shows a difference in the single and double ring with the Stevens packing, is that as the main ring bears on the bottom of the cylinder, and travels over the counter-bore, the single ring generally does not do so. In all cases that I have measured it, I never discovered it as being out of line. A small ring would show a shoulder at the top where it did not come in contact with the counter-bore, where the main ring, working over the counter-bore would show no shoulder. This is my experience with the Stevens packing. There is one thing we found when we commenced with the Stevens packing; it was fitted up too loose, and gave too much play to the ring, and used too great an amount of steam. We now fit it up very close, and find little difficulty in over-pressure.

Mr. Butterfield, St. P. & S. C. R. R.—I have had considerable experience with both the Dunbar and Stevens Packing. We tried the Dunbar packing and found it to work well. We fitted it up according to the directions of Mr. Dunbar, and ran it for twenty-six months and took no care of it, and when the engine came in for repairs, we found that the small rings were broken, and yet the packing never blowed and always worked well. We adopted the packing on the road. I was then foreman. The packing was adopted and used exclusively, and when I left the road and went to St. Paul, it became necessary on that road to renew the packing, and we tried Dunbar's. We had but a few engines, and none of the men had any experience running with Dunbar packing. I told one of the men that we would put in a set of the Dunbar packing as an experiment, and give it a trial. We never had any trouble with that packing. We subsequently supplied some of the engines with the Stevens packing and it blew, I presume, through not being properly fitted. It is my experience with steam packing, especially Dunbar's if it is not well fitted, it does not work well. I took the engine having the Stevens packing into the shop, and took the dimensions of the cylinder, and found it worn out of round. We turned a centre ring one inch wide, leaving each of the side rings three-fourths of an inch, making the width of the piston three inches, and put it in. At first it blew, because the rings were not supposed to fit the cylinder, which had been worn by the Stevens packing. The engine continued to work better, and after four or five weeks she did not blow through. The same packing is running yet, (now about three years), and has never given any trouble. When anything is causing trouble about an engine, perhaps the men in charge do not investigate and find the real cause of the imperfection. I had a man on the road who never used Dunbar's packing, but he took an old engine and put in a set. One side of the cylinder blew. He declared the packing bad. I did not want to quarrel with the man, but wanted to convince myself, as well as him, that we had a good thing in that packing. I investigated the affair, and found that the inside of the inner ring of the packing had worn nearly one thirty-second of an inch narrower than it should have worn, leaving just that much space for the steam to blow through. I have run the packing with four one-eighth inch holes, and with eight one-quarter inch holes. I believe in taking the different speeds of the engine under the different pressures, in considering this question. It is a very difficult mathematical question for a man to arrive at, as to how large these holes should be. As regards the old spring packing, I cannot say much. With regard to the rings dropping into the counter-bore, I don't think the inventor of the packing is responsible for that. As far as my experience has been, Dunbar's packing has always suited me. As I said before, I believe it is perhaps, the case that nearly all this packing that has failed, may have failed through some imperfection in fitting it up. I believe it necessary that the man should understand thoroughly all the imperfections in the cylinder, before condemning the packing.

Mr. Cummings, P. Ft. W. & C. R. R.—We have tried Stevens' packing, and have adopted it. I do not mean to say that the Dunbar packing does not work well, but that the Stevens' works better—in my experience.

Mr. Hill, E. R. R.—We had last winter twenty engines built. Ten engines had the Stevens Packing. The other ten had the Dunbar. The ten engines with the Stevens Packing commenced work last winter, and I think, with one or two exceptions, every cylinder has had to be bored out, the Stevens packing thrown away and replaced with Dunbar packing. Every engine with the Dunbar packing has run well, and with no change. The ten engines with the Stevens packing did the same kind of work as the ten engines with the Dunbar packing, and the packing of the former proved worthless, and that of the latter satisfactory. In the fall of 1860 I was on the Toledo road, and we put in a set of Dunbar packing. The packing ran five years. At the end of that time it was taken out, and it was found that the wear on the rings was less than that by the Stevens packing in one year. I am satisfied that the Dunbar packing is the best.

Mr. Burke, M. & C. R. R.—I was waiting in the hope that some gentleman of more experience than I would come up to advocate spring packing, the steam packing men seeming largely in the majority here. We purchased the right to use Dunbar's packing. I went on the road in 1865. I found nearly every engine on the road furnished with Dunbar packing. I have a very high regard for Mr. Dunbar, and have therefore hesitated to give my experience. The engines passed through the war, and I found nearly every one working badly. On examination, I found that each was provided with Dunbar packing. When this packing was put in the engines were nearly new; because the time when they went upon the road was very shortly before 1858, when the packing was put in. I found it necessary to bore every cylinder and to put in new packing, and then introduced Stevens' packing, and tried it in a freight engine of 16-inch cylinder. The engineer who had been running the engine under the old arrangement, came to me, and I told him that I wanted him to notice the new packing very particularly and let me know the result. It did not work satisfactorily, and he reported. I told him to give it a further trial. He continued to use it for six months, and every time I saw the engineer I talked to him about the new packing, and he was pleased with it. In 1868 Dunbar wanted me to try his packing again. I did so. I put it in the engine that had been run for five years, and am satisfied that I gave it a fair test, running it about three months, I abandoned all steam packing, and have now engines running with cast-iron packing, in the old way. So far as the labor of taking off the head to examine the packing, I venture the assertion that I can find engines on our road that have run twelve months with the cylinder-head unopened.

Mr. Sellers, D. M. V. R. R.—Every member is vitally interested in this question, and should avail himself of the opportunity to express his opinion. I would like to hear a still more general expression on this point; almost every man can give his experience. The general opinion has been expressed in favor of the Dunbar packing. We are very much indebted to Mr. Dunbar for what he has done for us. We set our packing under the old rule until it became unbearable; Mr. Dunbar came to our relief, but gave us an expensive packing. Mr. Stevens tried a cheaper kind, but arrived at the same expensive result. It is our object, now that we have done setting out steam packing, to obtain a packing that will do the work for a less amount of money. There is another paragraph in that report which relates to plugging up the holes. The question is, is that steam packing when the holes are plugged up? I have not been using either Dunbar's or Stevens' packing. We know that cast-iron packing works very well. I have adopted this plan. I take a solid ring, bore it out, and fit it over the points of the spider plate, and fit it into the cylinder. The advantage of this plan is that the work is all done on the lathe. There is no fitting up; I turn the ring out so that it will just fit the spider, and then turn three grooves in it, the middle one being the largest. I turn rings half an inch square, a little larger than the bore of the cylinder, saw them so that they spring open, fit them into their places, and when placed in the cylinder the spring in them holds them out against the surface for a long time. It is the cheapest packing that I know of. I don't believe in the expensive packing when you can get something to do the work without it. It is our object to arrive at a result as applicable as economical. We want to get the most economical thing to do the work.

Mr. Johann, P. R. R. of Mo.—I do not propose to discuss the question of packing, but to give my experience. I have had some five years experience with steam packing, and it has been precisely the same as that of Mr. Cummings. In 1865 I was in charge of the Pacific road. We were using spring packing. Mr. Stevens came along, or his agent, and urged me to use steam packing; I hesitated, I did not want to make any innovations, but would try it some day. He went off and this is about the last time I gave any attention to Stevens' packing. In the following year, Mr. Dunbar came, and in order to introduce his packing, proposed to fit it up himself and put it in. As it was a matter of little expense, I told him to do so. It was put in. I promised Mr. Stevens that I would try his packing, and I had a set of it put in with Dunbar's. We ran that packing six months. Stevens' packing did not do so well, and the engineer complained of it, although it was fitted precisely according to the specifications of Mr. Stevens. The Dunbar packing did very well. Then I went to work and doctored some of Stevens' packing. The engineer wanted the spring packing replaced. I found on examining Stevens' packing, that the ring had entirely too much play, and admitted too much steam. We then fitted up the rings closely, and from that time the Stevens' packing gave good satisfaction. We continued it six months longer, and examined both engines, and I was satisfied that Stevens' packing did as well as Dunbar's, which also did well. I adopted Stevens' packing, and put it into thirty engines, and it was run along up to 1868, with good results, at which time I left the road. In 1868 the road gauge was changed, and they purchased 46 new engines. Among them there were various kinds of packing. In 1870 I was recalled to the road, and found that Stevens' packing was going as well as before, and some other packing not so well; and to-day, in 72 engines we have Stevens' packing and it works well.

Mr. Young, C. C. C. & I. R. R.—I have had some experience with the different kinds of packing, spring and steam. I get very good results from both Stevens' and Dunbar's. But I found we could get a satisfactory result with Stevens' packing by fitting it very close and making the ring a very little larger than the cylinder, and cutting it so that the natural spring of it made it fit tight in the cylinder. It wants to be renewed once every six months. It is cheaper than the Dunbar at first, but the renewal makes the expense about the same. The constant blow of the engine through the packing consumes a great deal of fuel. I found also that Stevens' Packing wears the cylinder at the end. The Dunbar wears it very little. I have been using it some seven years in freight engines and find a good result. But for passenger engines and quick motion I prefer the old spring packing.

Mr. Setchell. L. M. C. & X. R. R.—About six years ago, the Master Mechanic of the road with which I am now connected, decided to put in some Stevens' Packing; he put in six sets, all in passenger engines. It was but a short time before wear on the cylinder could be noticed by measurement, and most of them were more or less cut. The engineer seemed to be dissatisfied with it, and the Master Mechanic threw it out, with the exception of one set; in that set he turned a groove in the ring and put a babbit in, thinking that that would prevent the cutting; he bored out the cylinder and put the engine on the track, but with the same result as before. It cut the cylinder and wore it large at the end. About that time I was called upon to take that engine, myself—ran it on a passenger train—we had invariably nine cars at a time. Ran opposite an engine with spring packing, and found that it beat me on the heaviest part of the road. I gave it as fair a trial as possible. Stevens thought it did good to put in the babbit. I finally came to the conclusion that I would like to try what virtue there was in the old spring packing; the Master Mechanic had a set put in—the engine carrying 125 pounds of steam. With the spring packing that I set out myself, I found that I could make the same time with one or two cars more. than I could with the Stevens' packing. I believe this is the experience of all these men who ran their engines with Stevens' packing. The Dunbar packing we have never used, though often solicited to do so by the patentee. Now we are using nothing but the old fashioned spring packing, and I must say that I think it the best.

Mr. Gregg, E. R'y.—The Stevens packing has several advocates, who, I have no doubt, are just as sincere in speaking of it as I am of the Dunbar; not positively for it, or in favor of any other. When Stevens fitted his packing up, he ran the rings precisely the diameter of the bore of the cylinder. It would be but a very short time before it would blow. Hence, just as soon as you begin to waste steam in that way, you are using a great deal more fuel in your engine than is necessary to do the work it ought to. To meet that very difficulty, we turned the packing ring larger than the bore of the cylinder, cut a small piece out, and then sprung the ring into the cylinder. The spring in the ring holds it tight against the cylinder. At first, when it was used, it would blow; but the spring of it would very soon wear the ring and the cylinder, and work tight, so that there would be little or no blowing. But you see readily that the spring would very soon wear out—the spring would be exhausted—and so, from the time the ring was worn down to the time it was taken out, the engine would blow. The consequence was, that the rings had to be replaced very often, and a great expense kept up. When the Dunbar packing is properly fitted up, it is really unnecessary to have the cylinder re-bored, if the cylinder is reasonably round; but if the cylinder is out of round, the packing will readily wear to the surface, and soon become tight. This is the advantage of the Dunbar over the Stevens' packing. To our friend, Mr. Setchell, who has just spoken of the Stevens packing, I can say that I do not value it as much as the other, for the reason that it keeps the engine blowing all the time. My experience is that Dunbar's packing proves the best. I would not go back to the old packing, because it entails a very heavy expense to keep it in good repair. The Dunbar packing is by far the best, though it costs the most to fit up. The great difficulty, all know, is in the expense of keeping engines in repair. It is better to pay a little more for the construction, in the first place, than to pay double for the repairs after.

Mr. Elliott, O. & M. R. R.—My experience and judgment is in favor of the Dunbar packing. I have tried Stevens and some other kinds, and have come to the conclusion that the Dunbar packing is the best. My experience teaches me, too, that packing failures are often attributable to the failure in the kind of iron used. In running Stevens' packing, the trouble is to keep the cylinders from cutting. I am disposed to attribute the failure of Stevens' packing to the quality of the iron used in the cylinder or piston. Some have said that soft iron is better for packing than hard; but I like hard iron better for this purpose. The Dunbar packing, in my judgment, is far preferable to any other. We ran the Stevens packing, but the trouble is in renewing the rings, and more or less blowing during the time when the rings are adjusting themselves to the cylinder.

Mr. Setchell, L. M. C. & X. R. R.—Master mechanics are forced to base their arguments and conclusions on what the engineer may say; very often they are prejudiced, and allow their feelings to govern their judgments, and make their decisions often without a fair trial or thorough investigation. For instance, you put on an apparatus that burns smoke, send it out with one engineer, who will tell tell you that it burns nearly all the smoke; and another engineer may declare just to the contrary; so it is with valves, and the same difference occurs in the opinion relating to packing. We make up our conclusions from the story of the engineer, bringing in, of course, all their prejudice, if they have any. If you get on to an engine and test this matter yourself, then you may arrive at a fair conclusion. Iron is the great difficulty, as its quality is hard or soft—that is my experience.

Mr. Little, P. P. & J. R. R.—I have had some experience in steam packing. In 1861 I put in the first steam packing, and put it into an engine with which we had a great deal of trouble, with the old-fashioned spring packing; that packing is still in, and the engine has lost very little time. About four years ago, at the solicitation of Mr. Stevens, I put in his packing; it ran for two years; when we had the engine in for repairs, I took the pistons out, laid them away until the engine was repaired, and put them in again, and they ran a year without giving any trouble. To decide between the packings, I could not, for I have used both, and both have given good satisfaction.

Mr. Towne, H. & St. J. R. R.—I think that steam packing is the best, because it is necessary to place everything important connected with the engine beyond the reach of the engineer. We are subject to employ all classes of men, many of them inferior. The demand for engineers is so great that we place engines in the hands of some men who are incompetent to attend to them. It is necessary that everything in the engine should be beyond the reach of the engineer to tamper with. Spring packing is not beyond their reach, and for that reason is not the thing for engines. Steam packing does not require to be set out on the road, it will run until the engine gets home; either gives some trouble; either does well. I left a road a few seasons ago to take charge of another, on which they had both the Dunbar and Stevens packing. Our engineers were very much opposed to the Stevens packing, and most of them in favor of Dunbar. The Stevens packing ran well. Since leaving that road the Master Mechanic has thrown out Stevens' packing, claiming that it cut the cylinders, and has put in the Dunbar. I cannot see any gain in the use of the Dunbar packing in those engines. Fitted up with two rings, I believe the Stevens packing is as good as Dunbar's. I believe, too, that one or the other is better than spring packing.

Mr. Gregg, E. R'y.—I would like to know what proportion of this house is in favor of either of these different kinds of packing? Stevens or Dunbar. We are not advocating the claims of the packing, so far as the inventors are concerned. I desire to know, however, which of these packings is the best. In order to get at it, I would suggest dividing the house; those in favor of the one to rise, while the others remain seated, and then *vice versa*. It is to know what the opinion of the various master mechanics is, that I suggest this division.

Mr. Burke, M. & C. R. R.—I wish the vote to be taken on the old-fashioned spring packing, also.

Mr. Gregg, E. R'y.—Certainly, if you wish.

Mr. Sellers, D. M. V. R. R.—I don't believe it is our place to make comparisons between one kind of packing and another, or to ask a division of the house, to say that Stevens' is better than Dunbar's. I do not think that it will be right for this body to make any decision in the matter. It is the place of the committee to report which, in its judgment, is the best. I do not wish this association to bias itself upon that question.

Mr. Gregg, E. R'y.—Without regard to advertising the claims of any party, I think I said, when I first got up, that I was not here to advocate the claims of either Stevens or Dunbar; but in dividing the house, we merely give the opinion of the house as to the worth of the packing, and arrive at a better conclusion which is the best to use, than by discussing it all day. For if we do this, we shall not find whether Dunbar has the best claim, or Stevens; and in order to know what claim is the best, I ask the division of the house on the subject. It is not, of course, to advertise Stevens or Dunbar, or the old-fashioned packing; I care no more for these patentees than they care about me—I would like to know the opinion of the master mechanics on this subject.

Mr. Hayes, I. C. R. R.—We have met here as a body of master mechanics, not to discuss any particular interest of this man, that man or the other man. It seems to me that if we force upon this house a vote upon the different kinds of steam packing, we will be doing injustice to the Master Mechanics' Association. The eyes of the community are upon us and we must be very careful in what we do. I have no objection to a vote as to the relative merits of steam, as against spring packing; but it is not for this association to say that Stevens' packing is or is not better than Dunbar's. It is the question of water and the kind of material you use, more than the different modes of applying packing. Water having a large amount of foreign matter in it will cut packing, while upon roads where the water is good and the iron good, you may run along satisfactorily with the same kind of packing as in the former case. You may discuss this matter until doomsday, and never arrive at the truth as to whether one is better than the other. I have no objection to the association voting as to whether spring packing is better than steam.

Mr. Burke, M. & C. R. R.—I think with Mr. Hayes, that it would be unjust, and would not be becoming to declare in favor or against any man's packing. The results with the same kind of packing may differ very much on various roads, according to the quality of the water and iron. I move that the house be divided on the question, as to the superiority of steam packing over spring.

The President—That motion cannot be entertained, unless Mr. Gregg withdraws his motion.

Mr. Gregg, E. R'y.—I do not see what objection there can be in dividing the house on the preference between Stevens' and Dunbar's packing; I cannot see the objection to it. We have expressed our views, why not vote as to our preference?

The President—It seems to me that we cannot arrive at a satisfactory decision, since there are many members who have no preference—liking and using both.

Mr. Brown, E. R. R.—I think the vote to be taken, should be on steam and spring packing. It would be unjust to our association to advertise any man's article; it is not expected of us. We should not force any kind of packing upon the public by our voice. The motion to vote upon steam and spring packing, is a very proper one. I don't think, however, that from us it requires any vote. I think the papers can do that business, and the men do the talking. Messrs. Dunbar and Stevens should have credit done them by the papers, as they deserve. I hope there will not be any vote.

Mr Setchell, L. M. C. & X. R. R.—I move that the motion be laid on the table.

Mr. Sellers, D. M. V. R. R.—From the remarks that have been made, I draw the conclusion that we are all opposed to expensive spring packing. I don't think it would be proper for us to take a vote on spring packing, however, as against steam packing; and finally I would not use steam packing or spring packing. I use the packing I have described to you. I put it in for less than the royalty we have to pay to parties for the use of their separate patents. I would ask the gentleman who made the motion to divide the house, to withdraw it.

The President decided the motion to lay on the table, made by Mr. Setchell, in order, and it was carried. Thus the matter was disposed of.

ELECTIONS AND APPOINTMENTS.

—At the late meeting of the Baltimore & Ohio Railroad Company, the following directors were chosen for the ensuing year: John Hopkins, Samuel W. Smith, Francis Burns, John Speer Nicholas, John Gregg, C. Oliver O'Donnell, James Harvey, Albert Schumacher, Galloway Cheston, Wm. W. Taylor, Samuel Kirby, Allen A. Chapman. These are the stockholder's representatives. Besides these the State of Maryland has eight and the city of Baltimore seven directors. Thus the city and State together can dictate the policy of the company.

—Col. Lockwood L. Doty, of New York, formerly Deputy Treasurer of the State of New York and afterward private secretary of Governor Morgan, and still later a collector of internal revenue, has been appointed Treasurer of the New Orleans, Mobile & Chattanooga Railroad.

—John W. Van Valkenburg, formerly Superintendent of the Albany & Susquehanna Railroad, has been appointed Superintendent of the Eastern Division of the Erie Railway.

—Johns Hopkins, Wm. McKim, Thomas Swan, John W. Garrett, Albert Schumacher, Galloway Cheston, Columbus O'Donnell, Wm. Keyser, and Charles M. Keyser, of Baltimore, P. G. Van Winkle and J. N. Camden, of Parkersburg, have been elected directors of the Parkersburg Branch Railroad. William Keyser was elected President *vice* P. G. Van Winkle, who declined a re-election.

—C. P. Huntington, A. A. Law, W. H. Aspinwall, Richard Irwin, Jonas B. Clark, and Wm. B. Hatch, of New York, Pliny Fisk, of Pennsylvania, H. C. Parsons, of West Virginia, John Echols, Wm. C. Wickham, and Joseph R. Anderson, of Virginia, have been chosen directors of the Chesapeake & Ohio Railroad.

—At the annual meeting of the Pittsburgh & Connellsville Railroad Company, held in Pittsburgh on the 5th inst., the following were elected directors: Wm. Oden Hughart, G. L. B. Fetterman, Wm. Phillips, Wm. Baldwin and Wm. S. Bissell, of Pittsburgh; Cyrus P. Markle, of West Newton; Cyrus Meyers, of Somerset; John Hopkins, Wm. H. Perkins, Israel Cohen, Hazeltine G. Vickery and Hugh Sisson, of Baltimore.

The following officers were chosen: W. Oden Hughart, President; J. H. Page, Jr., Secretary and Treasurer; Benj. H. Latrobe, Chief Engineer; George Shires, jr., Solicitor; D. D. Angell, Master of Transportation; D. P. Rannie, Master of Machinery; F. W. Smith, Master of Road; W. B. Stout, General Agent and Paymaster.

—The stockholders of the Toledo, Ann Arbor & Northern Railroad Company met at Ann Arbor, Mich., on the 9th inst., and elected as directors: Elijah W. Morgan, Prof. Silas H. Douglass, Judge Thomas M. Cooley, David Henning, James Clements, Charles Tripp, Rice A. Beal, Christian Eberbach, Ebenezer Wells, Joseph N. Wilcox and Herbert G. Williams. All of the directors except the last two named are residents of Ann Arbor.

—The Petersburg (Va.) *Courier* of December 3d says: "The following changes have been made upon the Atlantic, Ohio & Mississippi railway line, viz.: Mr. M. Peterson Goodwin, of this city, who has been lately stationed in Lynchburg, has been assigned to duty in Norfolk, as Freight Agent. Mr. John J. Hawkins has been made Freight Agent of both the Norfolk & Petersburg and Southside divisions of the road. Mr. N. T. Patterson has been appointed Ticket Agent of the Norfolk and Southside divisions, and Mr. T. D. Jellis is Freight Agent of the Virginia & Tennessee and Southside divisions, with headquarters in Lynchburg.

—A meeting of the new board of directors of the Plymouth, Kankakee & Pacific Railroad Company was held in Chicago on the 13th, at which James McGraw of Kankakee, Ill., was re-elected President; W. F. Singleton, of Momence, Ill., Vice-President: S. N. Hathaway, Treasurer; John C. Cushman, of Plymouth, Ind., Secretary, for the ensuing year.

—Hon. Wm. L. Banning, President of the Lake Superior & Mississippi Railroad Company, has resigned. It is reported that F. H. Clark, of the banking house of W. Clark & Co., of Philadelphia, will succeed him.

LOCOMOTIVE STATISTICS.

Louisville, Cincinnati & Lexington.

Mr. John Skidmore, Master Mechanic makes, the following abstract of locomotive performance for the year ending June 30, 1070:

There are 26 engines in use, of which 13 burn wood and 13 burn coal. The ordinary repairs for 620,895 miles run amounted to $21,511.13; for those due to accident $4,536.59, averaging 4.19cts. per mile run. The miles run to one cord of wood average 35.9; pounds of coal used per mile run 40.6. The cost per mile for repairs of wood-burning engines average 2.72cts., this large disproportion being due doubtless to the greater age of the wood burners. The aggregate cost per mile run is thus stated in items:—

Repairs, ordinary	3.46 cts.
" due to accidents	.73 "
Oil and tallow	1.30 "
Waste and rags	.23 "
Wood 10.79 }	9.46 "
Coal 8.87 }	
Engineering and firing	7.73 "
Watching and cleaning	.89 "
Water supply	1.09 "
Total cost per mile run	24.79 cts

In the account the cost of each particular service is kept distinct, and we find that the "Distributing" or switching engines, though not charged anything for accidents yet stand at the highest cost. The cost per mile run

For passenger engines	21.38 cts.
" freight engines	28.56 "
" distributing engines	33 69 "
Average cost	24.79 cts.

Of locomotives in use on this road nine were manufactured at the company's shops, three by the Baldwin Locomotive Works, two by the Schenectady Works, and twelve by the Rogers Works.

Toledo, Peoria & Warsaw.

The following is the report of the general average of performance of locomotives on the Toledo, Peoria & Warsaw Railway for the month of October, 1870, as made by A. H. de Clercq, Master Mechanic:

Cost per mile for engineers, firemen and wipers	6.81 cts.
Cost per mile for repairs of engine	6 77 "
Cost per mile for oil, waste, tallow and rags	1.29 "
Cost per mile for fuel	5.78 "
Total cost per mile run	20.66 cts.

Number of miles run to

Pint of oil	18.26
Ton of coal	48.27

Total number of engines 44, eleven of which made no mileage. Coal is charged at $2.75 per ton, wood at $4 per cord. The above includes oil used in headlights, oil used in engineers' lamps, superintendence, and all other expenses appertaining to the department.

Allegheny Valley.

Mr. G. W. Glass, Master Machinist of the company, reports for the month of October, 1870:

The number of miles run by trains was as follows:

Passenger trains	29,860
Freight "	55,552
Ballasting, &c	6,480
Total	91,892

The cost per mile run was:

For repairs	6.45 cts.
" fuel	4 83 "
" stores	.78 "
" engineers, firemen and wipers	7.60 "
Total cost per mile run	19.66 cts.

Average number of miles run to

Pint of oil	30.15
Ton of coal	36.75

Thiriy-five locomotives made mileage during the month. One new locomotive is building. The length of the road is 132 miles.

October Earnings of the Canada Railroads.

The table below we take from the *Canadian Monetary Times:*

Name of Road.	Passengers.	Mails and Sundries.	Freight.	Total 1870.	Total 1869.	Miles 1870.	Miles 1869.
Gt. Western	$148,079	$9,055	$197,021	$354,155	$340,616	351½	351½
Grand Tr'nk	274,129	28,500	487,493	790,122	789,994	1,377	1,377
London & Pt. Stanl'y	1,392	292	3,185	4,869	4,821	24½	24½
Welland	1,687	1,309	6,405	9,301	13,951	25	25
Northern	28,970	3,275	61,049	93,294	79,617	97	97
St. Lawrence & Ottawa*	5,867	987	6,560	13,394	10,345	54	54
St. Lawrence & Industry	368	.....	874	1,242	1,233	....	....
European & N. Amer.	8,590	777	13,491	22,858	18,087	108	108
Nova Scotia	11,267	961	19,107	31,335	25,849	145	145
Total	$480,349	$45,036	795,185	1,320,570	1284,513	2,182	2,182

—The Pennsylvania Supreme Court has decided that if a man puts his head or his arm through a car window and is injured by contact with something which reaches close to the window, he cannot recover for the injury, the act being considered negligence on the part of the passenger.

PUBLISHER'S ANNOUNCEMENTS.

Railroad Gazette Clubs.

The railroad men of this country are as a rule, in whatever capacity they may serve, ambitious to understand thoroughly their calling and anxious to keep informed on all subjects connected with it. This disposition has been of late exemplified in a very pleasant manner to us by the readiness with which certain clubs for the RAILROAD GAZETTE have been raised. The most notable instances so far have been those obtained at the Weldon shops of the Illinois Central and at the Aurora shops of the Chicago, Burlington & Quincy. A short time ago a list of *forty* was sent from the former, which we thought was exceedingly well done; but last week one of our very good friends from Aurora brought us a club of eighty-five! accompanied by the funds, of course. It has pleased us exceedingly to learn that the subscribers were obtained, not without effort indeed, but readily and without urging. The men wanted the paper, and when it was brought to their notice they were ready to subscribe for it. Other clubs not yet completed may surpass these; we hope they may; but we note these as examples. Meanwhile we shall be glad to receive more like them as well as smaller ones, and beg our readers to remember that but a short time yet remains to take advantage of the present low rates. Clubs of ten or more completed by the 31st inst. will be received at $2.50 each. Afterwards our lowest club rates will be $3 and single subscriptions $4.

In a number of places within two or three weeks clubs have been started at shops, etc., and wherever a little effort was made a considerable number of subscribers has been obtained. If the men see the paper, no urging is needed, as it speaks for itself Only the friendly use of a ready pencil and sheet are necessary to take the names.

—The Sioux City *Journal* understands that the Western Union Telegraph Company has opened negotiations for the purchase of the telegraph line between Sioux City and Missouri Valley, and that if it does not succeed in obtaining control of this line, intends to run an independent line from Missouri Valley.

WANTS.

WANTED—A complete file of the RAILROAD ADVOCATE published in New York by Zerah Colburn about 15 years ago. A purchaser can be found by applying at this office personally or by letter.

AN ENGINEER experienced in railroad location and construction as Principal Assistant and Chief is open to an engagement. For further information inquire of the editor of this paper.

WANTED - Every Railway Traveler in the United States and the Dominion of Canada wants every railway company to use the Thomas Safety Baggage Check. It is in use on over sixty of the best managed roads in the country and has been during the past three years, and not one piece of baggage to which this check has been attached has been lost or miscarried. Every railroad man upon whose road it is in use says:

"*We are fully satisfied after a thorough trial and practical use of the Thomas Safety Baggage Check that both for local and through business it has no equal. It is cheaper, more satisfactory and better adapted to the business than any other check in use.*"

All information in reference to the Thomas Safety Baggage Check will be given by addressing G. F. THOMAS, editor Appleton's Railway Guide, 90, 92 and 94 Grand Street, New York.

Substantial Success Based on Merit!

The Iron World & Manufacturer

Is Published Weekly at Pittsburgh, Pa.,

And is the Leading—if not the only—Representative Journal of the METAL TRADES Published in the United States.

Located at the very centre of the metal interests of the United States, with offices and correspondents at the leading cities of the East, West and South, we do not err in claiming that it is the REPRESENTATIVE JOURNAL of the Metal Manufacturers, Workers and Dealers, of this country.

The IRON WORLD AND MANUFACTURER has a large and extended circulation throughout the United States, and is taken by Iron and Steel Manufacturers, Machinists, Founders, Hardware Dealers and Tinners, Gunsmiths, Plumbers, Cutlery Manufacturers, File Manufacturers, Saw Manufacturers, Boiler Manufacturers, and by

Leading Railway Officials.

It advocates protection to AMERICAN MANUFACTURES! Its markets are FULL AND RELIABLE. Able Correspondents traveling in the WEST AND SOUTH Manufacturing Items are a leading feature. Its manufacturing items are copied by the Press throughout the country.

Only $4.00 per Annum.

If you are in the metal trade, take a metal paper. It will save you more than its cost. If you are a manufacturer take the journal that advocates your interests. Don't patronize Free Trade journals, but help those who help you.

With Free Trade the manufacturers of the country would be ruined! English gold is scattered with a liberal hand to further Free Trade. Expend some of yours to favor Protection.

If you advertise, which is the best medium? Circulation being equal which would you patronize—a Free Trade journal or a Protection journal? Circulation is considered the value of an advertising medium. Much depends on the CHARACTER of the circulation. The New York *Weekly Tribune* claims 200,000 circulation, and gets from two to five dollars per line for advertising. The IRON WORLD reaches more people engaged in the metal business that the New York *Tribune*. Our rates are about ten cents per line. Which will pay the best?

Sample Copies Mailed Free.

Address IRON WORLD PUBLISHING CO.,
No. 71 Grant St., Pittsburgh, Pa.

RUFUS BLANCHARD,

146 Lake St., Chicago,

Has Issued a NEW STYLE of

MAPS!

IN FLEXIBLE CASES,

Which are both cheap and convenient. The following States are now ready: Illinois, Iowa, Missouri, Kansas, Nebraska, Minnesota, Wisconsin, Indiana, Michigan and Ohio. Mailable on receipt of 25 cents. They show the counties, towns and railroads and are fine specimens of workmanship.

KELLOGG BRIDGE COMPANY,

OF BUFFALO, N. Y.,

Manufacturers of all kinds of

Wrought Iron Truss Bridges,

Iron Roofs and Viaducts.

☞ Plans and prices sent on application. Address KELLOGG BRIDGE CO., Buffalo, N. Y.

CHAS. KELLOGG, President.
CHAS. F. WADSWORTH, Vice-Pres.
C. C. HODGES, Sec'y and Treas.
THOS. M. GRIFFITH, Sup't.

VAN NOSTRAND'S

Eclectic Engineering Magazine,

Commenced January, 1869.

Consists of Articles selected and matter condensed from all the Engineering Scientific Serial publications of Europe and America.

The third volume of this Magazine is completep by the issue for December.

The growing success during the past two years demonstrates the correctness of the theory upon which the enterprise was founded. Communications from many sources prove that the Magazine has met a wide-spread want among the members of the engineering profession.

A summary of scientific intelligence, selected and sifted from all the great list of American and European scientific journals, is at present afforded by no other means than through the pages of this Magazine.

In the next volume, beginning with the January number, we shall commence some important improvements. Each number of the Magazine will hereafter contain something of value relating to each of the great departments of engineering labor.

More space than heretofore will be devoted to short discussions or elucidations of important formulæ, especially such as have proved valuable in the practice of working engineers; our facilities for affording such items are extensive and rapidly increasing.

The progress of great engineering works in this country will be duly chronicled.

Selected and condensed articles, with their illustrations, from English, French, German, Austrian, and American scientific periodicals, will contribute to make this Magazine more than ever valuable to the engineering profession, and will afford a compilation without which the library of the working engineer will be incomplete.

112 *Pages, large* 8vo., *Monthly. Price* $5 *a year in advance; single copies* 50c.

NOTICE TO NEW SUBSCRIBERS.—Persons commencing their subscriptions with the Third Year (January, 1871,) and who are desirous of possessing the work from its commencement, will be supplied with Volumes I., II. and III., neatly bound in cloth, for $10.00, sent free by mail on receipt of price.

NOTICE TO CLUBS.—An extra copy will be supplied gratis to every Club of Five subscribers at $5.00 each, sent in one remittance.

D. VAN NOSTRAND,
Publisher, Importer and Bookseller,
23 Murray and 27 Warren Street, New York.

TRIAL.

No..... **W. P. Garrison, Box 6732, N. Y,**

Send THE NATION for two months (8 numbers *from the last*) *to*.....

.....

Procured by.....

On receipt of fifty cents and this blank, filled out, the *Nation* will be sent to your address for two months (8 numbers), *postage prepaid*.

"The *Nation* I esteem as one of the very best, highest-toned moral newspapers in the country."—*From a Sermon by Rev. Henry Ward Beecher.*

"I regard the *Nation* as the best journal in America, and not only so, but better, on the whole, than any in England."—*Prof. Goldwin Smith.*

"I have never taken a weekly newspaper which in all its departments is so satisfactory as the *Nation*."—*Hon J. D. Cox, (Secretary of the Interior.)*

Terms $5 per annum. Clergymen $4.

ESTABLISHED 1820.

WM. J. YOUNG & SONS,

MANUFACTURERS OF

Mathematical and Engineering

INSTRUMENTS.

No. 43 NORTH SEVENTH ST.,

Philadelphia.

ALBERT C. McNAIRY, President. HENRY M. CLAFLEN, Vice-Pres't & Treas.

CLEVELAND

Bridge & Car Works,

THE McNAIRY & CLAFLEN MANUF'G CO., Proprietors,

BUILDERS OF

Railway and Highway Bridges,

Roofs, Turn Tables, Transfer Tables,

OF IRON AND WOOD,

RAILROAD PASSENGER & FREIGHT CARS,

STREET RAILROAD CARS.

Post's Patent Iron and Combination Bridges, Howe Truss Bridges with Patent Iron Clamp, Street Railroad Cars with Higley's Patent Running Gear and Brake.

OFFICES: Waring Block, cor. Bank and St. Clair Sts., | WORKS: On Wason, Hamilton and Lake Sts.,

CLEVELAND, OHIO.

HARVEY T. CLAFLEN, Sup't. JOHN COON, Sec'y. SIMEON SHELDON, Engineer.

The Lightest Running,

EASIEST RIDING,

— AND —

Most Economical

STREET CAR

IN USE.

HIGLEY'S PATENT

Street Car Running Gear

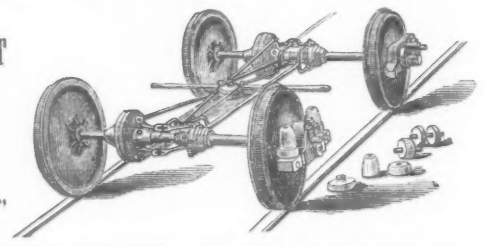
— AND —

BRAKE,

Made and Sold by

The McNairy & Claflen Manuf'g Co.,

CLEVELAND, O.



THE

Commercial & Financial Chronicle,

PUBLISHED WEEKLY

IN NEW YORK,

— IS THE —

Standard Financial Newspaper of the Country

CAR SPRINGS (RUBBER)

FOR SALE.

About one and a half tons sizes, and good quality—open to offers to clear.
Address "L," Box 672, New York.

THE UNITED STATES

Railroad and Mining Register,

[Established 31st May, 1856.]

Is Published Every Saturday, by

"The United States Railroad and Mining Register Company,"

— AT —

423 Walnut St., PHILADELPHIA.

J. P. LESLEY, EDITOR.

Devoted to Railroads, Mines, Iron, &c

TERMS—$3.00 per Annum, in Advance.

To subscribers in Great Britain, 18s. ($4.00) payable in advance.

☞ Address all business communications to

THOS. R. DAVIS, Treasurer,
423 Walnut St., Phila.

Baldwin Locomotive Works.

M. BAIRD & CO., Philadelphia,

MANUFACTURERS OF

Locomotive Engines,

ESPECIALLY ADAPTED TO EVERY VARIETY OF RAILROAD SERVICE,

—AND TO—

The Economical Use of Wood, Coke, Bituminous and Anthracite Coal as Fuel.

ALL WORK ACCURATELY FITTED TO GAUGES, AND THOROUGHLY INTERCHANGEABLE.

Plan, Materials, Workmanship, Finish and Efficiency, Fully Guaranteed.

M. BAIRD. CHAS. T. PARRY. WM. P. HENSZEY.
GEO. BURNHAM. EDW'D H. WILLIAMS. EDW'D LONGSTRETH.

GRANT

Locomotive Works!

PATERSON, N. J.

New York Office, - - 48 Wall Street.

GEO. WESTINGHOUSE, Jr., Pres. ROBERT PITCAIRN, Treas. RALPH BAGALEY, Secretary.

Westinghouse Air Brake Company,

OF PITTSBURGH. Incorporated by the State of Pennsylvania, 1869

MANUFACTURERS OF

THE WESTINGHOUSE AIR BRAKE!

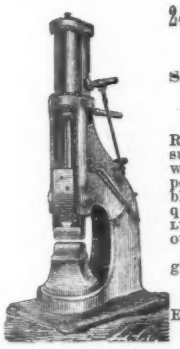
A simple, cheap and effective invention, whereby the entire control of a train of cars is placed in the hands of the Engineer. It is in daily use on a number of the leading Railroads, and is recommended by the most prominent railroad mechanics in the country as an actual necessity.

A Trial Train furnished to any Railroad Company, to be paid for only when found satisfactory. Full information furnished on application.

FERRIS & MILES,

Steam Hammers & Machine Tools

24th and Wood Streets, PHILADELPHIA.



THE STEAM HAMMER AS IT SHOULD BE!

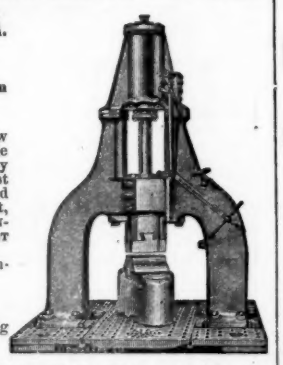
Simple in Construction—Powerful in Action—Convenient in Handling —Moderate in Price!

These Hammers have our Patent Skew Ram, which secures the most extensive die surface, and our patent valve gear; by which is accomplished, with the most perfect adjustment, either the heavy dead blow for drawing down work, or the light, quick blow for finishing, AND THIS WITH ONLY TWO MOVING PIECES—NOTHING TO GET OUT OF ORDER.

All sizes, from 100 lbs. upwards, with single or double frames.

ENGINE LATHES,

Extra Strong and Heavy, capable of doing the heaviest and most accurate work.



Also, our **PATENT SCREW-CUTTING LATHES,** which will do either general turning or screw cutting, without change of gear-wheels.

The New Jersey Steel and Iron Co.,

TRENTON, N. J., and 17 BURLING SLIP, NEW YORK,

WOULD CALL SPECIAL ATTENTION TO THEIR

MARTIN STEEL!

Acknowledged by all who have used it to be the best material now made for

Fireboxes Plates, Locomotive Crank Pins, Piston Rods, Axles,

And all the finer machine purposes, such as

Rollers for Cotton Machinery, Lathe Screws, Sewing Machine Work, &c., &c.

The special features of this Steel are its REMARKABLE TOUGHNESS, its softness and entire freedom from hard spots, which obviate the necessity of annealing before turning.

The process by which this Steel is made differs entirely from any other in use, enabling it to be sold at lower prices than any other good steel, while it possesses properties hitherto unknown, and of the greatest importance for many uses.

FOR SALE!

Railroad Supplies.

—THE—

UNION PACIFIC R. R. CO.

ARE NOW OFFERING FOR SALE,

At Reduced Prices,

A very extensive Stock of all kinds of

RAILROAD & CONTRACTORS'

SUPPLIES,

And are prepared to furnish Contractors, Builders and Jobbers with the following

STORES:

Scrapers,	Stone Hammers,
Wheel Barrows,	" Picks,
Iron Beam Plows,	B. S. Sledges,
Wood Beam Plows,	Double Faced Sledges,
Plow Points,	Steel " "
Carts,	Stone Axes,
Cart Harness,	" Tooth Axes,
Round Point Shovels,	Hand Drills,
Spades,	Horse Power Drills,
R. R. Picks,	Anvils,
Steel Pointed Picks,	Steel Punches,
Steel Drills,	Portable Forges.
Striking Hammers,	Horse Pile Drivers,
Crow Bars,	Pile Hammers,
Tamping Picks,	Derrick Castings,
Cast Iron Turntable,	Broad Axes,
Switches, complete,	R. E. Adzes,
Frogs, "	Ship Augers,
Hand Switches,	Buttresses,
Tanks, complete,	Steel Squares,
Wind Mills,	Trowels,
Broad Axe Handles,	Powder,
Hammer "	Tape Fuse,
Pick "	Cotton Fuse,
Hand Pumps,	Glycerine Tubes,
Power "	" Fuse,
Sand "	Electric Exploders,
Fence Posts,	Buildings,
Steel, Iron, Bolts,	Lumber, Box Cars,
Screws, Castings,	Flat Cars, Coaches, &c.

N. B.—The above list of material was purchased by the Contractors to be used in the construction of the U. P. R. R., and on its completion remained on hand as a surplus. Address

Gen. C. M. DODGE,
COUNCIL BLUFFS, Or
J. M. EDDY,
U. P. R. R., OMAHA, Nebraska

ANDREW CARNEGIE, PRESIDENT. | THOS. M. CARNEGIE, VICE-PRESIDENT.
ANDREW KLOMAN, GEN. SUP'T.

THE UNION IRON MILLS,

Of PITTSBURGH, Pa.

Sole Manufacturers, under our own Patents, of

IMPROVED "I" BEAMS,
CHANNEL BARS,
Best Quality of
LOCOMOTIVE & CAR AXLES.
("KLOMAN" Brand.)
"Linville & Piper's Patent"
Round and Octagonal HOLLOW WROUGHT IRON POSTS,
—AND—
"Upset" BRIDGE LINKS

GENERAL WESTERN OFFICE:
No. 13 Fullerton Block, Dearborn-St.,
CHICAGO, ILLINOIS.

THE UNION IRON MILLS manufacture all sizes of Pipe Iron, Merchant Bar, Forgings, Hammered and Rolled Locomotive and Car Axles, from the very best iron. Splice Bars (or Fish Plates,) to suit all Patterns of Rails. Bridge Iron and Bolts "I" Beams, Girder Iron, Channel Iron, &c.

WALTER KATTE, Western Agent.

Bigelow & Johnston,

48 PINE ST., NEW YORK,

ENGLISH AND AMERICAN

STEEL AND IRON RAILS

—AND—

RAILROAD SUPPLIES.

☞ Special quotations given for Locomotives, Cars, Chairs, Spikes, Fish-Plates, Bolts, Nuts, Scrap Iron, Old Rails and Metals generally.

UNION TRUST CO.,

OF NEW YORK.

No. 73 Broadway, cor. Rector St.

***Capital*, - - 1,000,000.**

[All paid in and securely invested.]

INTEREST ALLOWED ON DEPOSITS, which may be drawn at any time.

This Company is by law and by the order of the Supreme Court made a legal depository of money. It will act as Receiver in cases of litigation, take charge of, and guarantee the safe keeping of all kinds of Securities, and collect coupons and interest thereon.

It is authorized by law to accept and execute all TRUSTS of every description, in reference to both real and personal property committed to them by any person or corporation, or transferred to them by order of any of the Courts of Record, or by any Surrogate.

It is especially authorized to act as Register and Transfer agent and as Trustee for the purpose of issuing, registering or countersigning the certificates of stock, bonds or other evidences of debt of any corporation, association, municipality, State or public authority, and will pay coupons and dividends on such terms as may be agreed upon.

In giving special prominence to this department of its business, attention is particularly called to the paramount advantages of employing this COMPANY in the capacity of AGENT, TRUSTEE, RECEIVER or TREASURER, in preference to the appointment of INDIVIDUALS. A guarantee capital of ONE MILLION DOLLARS specially invested by requirement of its charter, and a perpetual succession; a central and permanent place of business, where business can be transacted daily, without disappointment or delay: its operations directed and controlled by a responsible Board of Trustees; and its entire management also under the supervision of the Supreme Court and the Comptroller of the State.

Permanency, Constant and Responsible Supervision, Guaranteed Security and Business Convenience and Facilities, may therefore be strongly urged IN ITS FAVOR on the one hand, against the Uncertainty of Life, the Fluctuations of Business, Individual Responsibility and General Inconvenience on the other.

ISAAC H. FROTHINGHAM, President.

AUGUSTUS SCHELL, HENRY K. BOGERT, } Vice-Presidents.

TRUSTEES.

A. A. LOW,	JOHN V. L. PRUYN,
HORACE F. CLARK,	BENJ. H. HUTTON,
DAVID HOADLEY,	JAS. M. McLAIN,
EDWARD B. WESLEY,	W. WHITEWRIGHT, Jr.
GEO. G. WILLIAMS,	HENRY STOKES,
J. B. JOHNSON,	HENRY E. DAVIES,
GEO. B. CARHART.	SAMUEL WILLETS.
PETER B. SWEENEY,	CORNELIUS D. WOOD,
JAS. M. WATERBURY,	S. B. CHITTENDEN,
FREEMAN CLARK,	DANIEL C. HOWELL,
AMASA J. PARKER,	GEORGE W. CUYLER,
HENRY A. KENT,	JAMES FORSYTH,
WILLIAM F. RUSSELL,	R. J. DILLON,
S. T. FAIRCHILD.	

CHARLES T. CARLTON, Secretary.

TO THE WORKING CLASS.—We are now prepared to furnish all classes with constant employment at home, the whole of the time or for the spare moments. Business new, light and profitable. Persons of either sex easily earn from 50c. to $5 per evening, and a proportional sum by devoting their whole time to the business. Boys and girls earn nearly as much as men. That all who see this notice may send their address, and test the business, we make this unparalleled offer: To such as are not well satisfied, we will send $1 to pay for the trouble of writing. Full particulars, a valuable sample, which will do to commence work on, and a copy of *The People's Literary Companion*—one of the largest and best family newspapers published—all sent free by mail. Reader, if you want permanent, profitable work, address E. C. ALLEN & CO., Augusta, Maine.

WM. U. THWING,

PATTERN

—AND—

Model Maker!

Calhoun Place, Rear of No. 120 Dearborn Street, Chicago, Third Floor.

Employing none but the best workmen, and having superior facilities, I am prepared to do the best work (using the best materials) at low figures, and guarantee satisfaction. Patent Office Models a specialty.

ILLINOIS

Manufacturing Co.,

479, 481 & 483 STATE ST., CHICAGO,

Manufacturers of

RAILWAY CAR TRIMMINGS,

AND

Removable Globe Lanterns.

O. A. BOGUE, Pres. JAS. E. CROSS, Supt.
A. H. GUNN, Sec'y. J. M. A. DEW, Ass't Supt.

SEWER PIPE, DRAIN TILE,

Bath Brick & Fire Brick,

Manufactured and Sold by

THE JOLIET MOUND CO.,

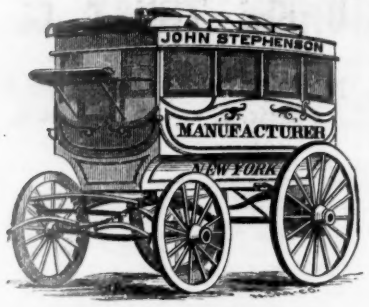
Joliet, Will Co., Illinois.

Office and Yard in Chicago,

Cor. Washington & Market Streets.

☞ Orders and inquiries promptly attended to.

JOLIET MOUND CO.



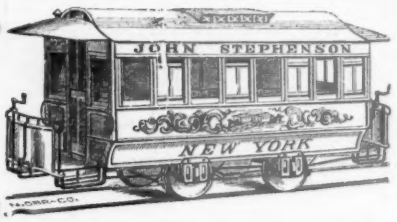
OMNIBUSES

—OF—

EVERY STYLE!

☞ Orders Promptly Filled. ☜

CARS,



LIGHT, STRONG

—AND—

ELEGANT!

J. H. LINVILLE, PRESIDENT. J. L. PIPER, GEN. MANAGER. A. G. SHIFFLER, SUP'T & TREAS.

The Keystone Bridge Company

OF PITTSBURGH, PENN.

Office and Works, 9th Ward, Pittsburgh, Pa. Philadelphia Office, 426 Walnut Street.

GENERAL WESTERN OFFICE:—13 Fullerton Block, 94 Dearborn St., CHICAGO, ILL.

☞ This Company possess unrivaled facilities for manufacturing and erecting every description of **Iron and Wooden Railway and Road Bridges, Roofs, Turn-Tables and Buildings, "Linville and Piper" Patent Iron Bridges, Self-Sustaining Pivot Bridges, Suspension Bridges, and Ornamental Park Bridges.** Contractors for Wooden or Iron Bridges of any pattern, as per plans and specifications. Circulars sent on application.

WALTER KATTE, ENGINEER. A. D. CHERRY, SECRETARY.

CRERAR, ADAMS & CO.,

MANUFACTURERS AND DEALERS IN

Railroad Supplies!

—AND—

CONTRACTORS' MATERIAL.

11 and 13 Wells Street,

CHICAGO, ILL.

Manufacturers of IMPROVED HEAD-LIGHTS for Locomotives, Hand and Signal Lanterns, Car and Station Lamps, Brass Dome Casings, Dome Mouldings, Cylinder Heads, and Car Trimmings, of Every Description.

PITTSBURGH CAST STEEL SPRING WORKS

A. French & Co.,

Manufacturers of Extra Tempered, Light Elliptic

CAST STEEL SPRINGS,

FOR RAILROAD CARS AND LOCOMOTIVES,

FROM BEST CAST STEEL.

OFFICE AND WORKS:—Cor. Liberty and 21st Sts., PITTSBURGH, PA.

CHICAGO BRANCH, 88 Michigan Ave.

Geo. C. Clarke & Co.,

FIRE, INLAND AND OCEAN MARINE

INSURANCE AGENCY.

15 Chamber of Commerce, Chicago.

New England M. M. Insurance Co., of Boston,
ASSETS $1,197,000.

Independent Insurance Company, - of Boston,
ASSETS $680,000.

North American Fire Ins. Co., of New York,
ASSETS $800,000.

Excelsior Fire Insurance Co., - - of New York,
ASSETS $340,000.

Fulton Fire Insurance Company, of New York,
ASSETS $400,000.

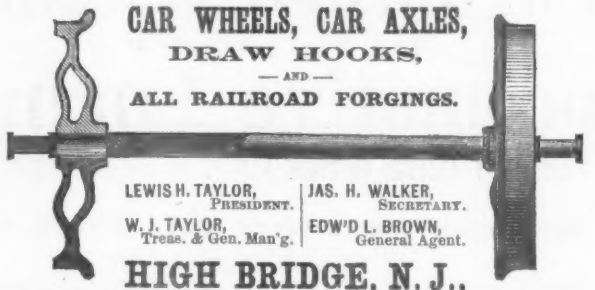
Home Insurance Company, - of Columbus, O.
ASSETS $515,000.

TAYLOR IRON WORKS!

CAPACITY: 120 WHEELS, 50 AXLES, and 100 HOOKS PER DAY.

MANUFACTURERS OF

WHEELS AND AXLES, made in the best and most careful manner, turned separately, or "fitted," making complete sets.



CAR WHEELS, CAR AXLES,

DRAW HOOKS,

—AND—

ALL RAILROAD FORGINGS.

STANDARD DRAW HOOKS, finished, ready for immediate use, with Nuts and Nuts and Plates, with or without links.

LEWIS H. TAYLOR, President. | JAS. H. WALKER, Secretary.

W. J. TAYLOR, Treas. & Gen. Man'g. | EDW'D L. BROWN, General Agent.

HIGH BRIDGE, N. J.,

On the Line of the Central Railroad of New Jersey.

The National Iron Co.

[Successor to Wm. Hancock, Rough and Ready Iron Works,]

ESTABLISHED 1847.

DANVILLE, PENNSYLVANIA.

MANUFACTURER OF

RAILROAD IRON,

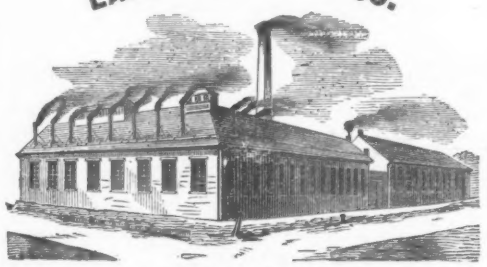
RAILROAD CHAIRS, SPLICE BARS AND BOLTS, FROGS, SWITCH RODS, STANDS AND LEVERS, HOOKHEAD AND COUNTERSUNK HEAD SPIKES, BRIDGE AND CAR BOLTS, ROLLS AND ROLLING MILL MACHINERY, BLAST FURNACE CASTINGS AND MACHINERY, STEAM ENGINES AND BOILERS, IRON AND BRASS CASTINGS, ENGINE AND MACHINE WORK, STEAM & WATER FITTINGS, &c., &c.

WM. HANCOCK, President.

BENJ. J. WELCH, Sec'y, Treas. and Gen. Manager, Danville, Pa. | P. C. BRINCK, Vice-President, 401 Walnut St., Philadelphia.

FILES

LANCASTER FILE CO.



FILES

MANUFACTURERS OF

Superior Cast Steel Files.

LANCASTER, PA.

MANSFIELD ELASTIC FROG COMPANY

OF CHICAGO.

AMOS T. HALL, President. | J. H. DOW, Superintendent.

Are now prepared to receive and promptly execute orders for RAILROAD FROGS and CROSSINGS warranted to prove satisfactory to purchasers

For DURABILITY, SAFETY and ELASTICITY—being a combination of Steel, Boiler Plate and Wood—they are UNEQUALED, as Certificates of Prominent Railroad Officials will testify.

The SAVING TO ROLLING STOCK AND MOTIVE POWER is at least equal to double the cost of the FROG. Letters should be addressed to

CRERAR, ADAMS & CO., Gen'l Agents,

No. 13 Wells Street. CHICAGO.

L. B. BOOMER, Pres. H. A. RUST, Vice Pres. W. E. GILMAN, Secretary.

American Bridge Company,

Manufacturers and Builders of

BRIDGES, ROOFS,

Turning Tables, Pivot Bridges, Wrought Iron Columns, Heavy Castings, and General Iron and Foundry Work.

For Railway and Road Bridges, this Company employs the following well-established systems, viz: *For Bridge Superstructures.*—Post's Patent Diagonal Iron Truss; Plate and Trussed Girders; Post's Patent Diagonal Combination Truss; Howe's Truss, and any other desired systems. *For Bridge Substructures.*—Pneumatic, Screw Piles and Masonry.

☞ Descriptive Lithographs furnished upon application. Plans, Specifications and Estimates, together with Proposals, will be made and submitted, when desired.

WORKS, Cor. Egan and Stewart Avenues. | OFFICE, Rooms 1, 2 & 3, 157 LaSalle St.

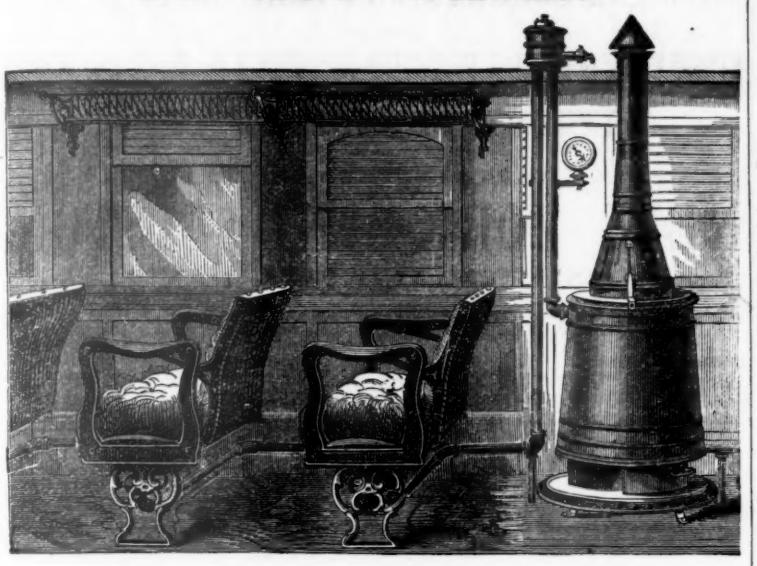
Address THE AMERICAN BRIDGE CO.,
No. 157 LaSalle St., Andrews' Bldg., Chicago.

L. C. BOYINGTON, Gen. Agent. M. LASSIG, Gen. Supt.

WARMING AND VENTILATING

Railroad Cars

BY HOT WATER.



BAKER'S PATENT CAR WARMER.—One way of Applying it.

A very simple, safe and efficient plan for

Warming Railway Carriages!

—BY—

HOT WATER PIPES,

Which Radiates the Heat Directly at the Feet of Each Passenger without the Necessity of Going to the Stove to Get Warmed!

☞ All the finest Drawing-Room and Sleeping Cars in the United States have it, or are adopting it. Full descriptive Pamphlets furnished on application.

Baker, Smith & Co.,

Cor. Greene and Houston Sts., N. Y., and 127 Dearborn St., Chicago.

THE LEBANON MANUFACTURING COMPANY,

LEBANON, PENNSYLVANIA,

IS PREPARED TO BUILD AT SHORT NOTICE,

HOUSE, GONDOLA, COAL, ORE,

AND ALL OTHER KINDS OF

CARS!

Also, IRON and Every Description of CAR CASTINGS Made to Order.

DR. C. D. GLONINGER, President. J. M GETTEL, Superintendent.

HUSSEY, WELLS & CO.,

MANUFACTURERS OF ALL DESCRIPTIONS OF

CAST STEEL.

BEST REFINED STEEL FOR EDGE TOOLS.

Particular attention paid to the Manufacture of

Steel for Railroad Supplies.

HOMOGENEOUS PLATES,

For Locomotive Boilers and Fire Boxes.

Smoke Stack Steel, Cast Steel Forgings,

FOR CRANK PINS, CAR AXLES, &C.

Also, Manufacturers of the Celebrated Brand,

"HUSSEY, WELLS & CO. CAST SPRING STEEL."

☞ **For Elliptic Springs for Railway Cars and Locomotives.** ☜

Office and Works, Pittsburgh, Pa.

BRANCH WAREHOUSES:

88 MICHIGAN AVENUE, CHICAGO.

139 and 141 Federal St., BOSTON. | 30 Gold St., - - - NEW YORK.

JOHN B. TAFT, AGENT, No. 10 OLIVER STREET, BOSTON. Leeds. Taylors.

TAYLOR BROTHERS & CO.

CAST STEEL LOCOMOTIVE TYRES,

Best Yorkshire Bar Iron

— AND —

BOILER PLATES.

This Iron is unequaled for strength and durability, soundness and uniformity It is capable of receiving the highest finish, which renders it peculiarly adapted to the manufacture of Locomotive and Gun Parts, Cotton and other Machinery Chain Bolts, &c.

Sole Agency for the United States and Canadas.

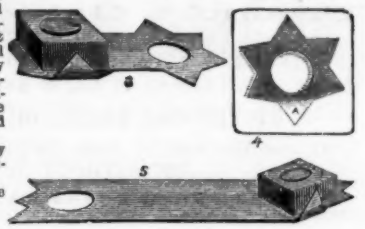
THE UNION PATENT STOP WASHER,

Manufactured at Coatesville, Chester Co., Pa., on the line of the Pennsylvania Central R. R., has now stood the test of practical use on the above road, the Philadelphia, Wilmington & Baltimore and Philadelphia & Reading Railroads, for the past two years, and proved itself to be what is claimed for it—a perfect security against the unscrewing or receding of nuts. Its simplicity, efficiency and cheapness over any other appliance for the purpose should recommend it to the attention of all persons having charge of Railroad tracks, cars and machinery.

It is especially adapted to. and extensively used by leading Railroads of the country for the purpose of securing nuts on railway joints.

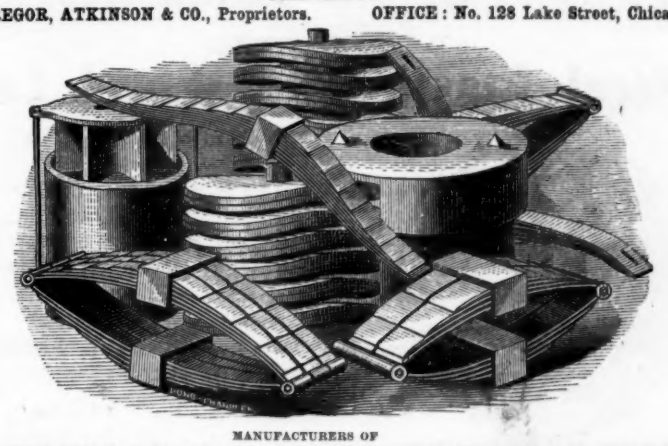
The accompanying cuts show the application of the Washer. For further information, app y to

A. GIBBONS, Coatesville, Pa.



The Chicago Spring Works.

McGREGOR, ATKINSON & CO., Proprietors. **OFFICE: No. 128 Lake Street, Chicago.**



MANUFACTURERS OF

EXTRA TEMPERED LIGHT ELLIPTIC CAST STEEL SPRINGS AND THE "DANIELS" PAT. CAR SPRING.

Union Car Spring Mf'g Co.

Sole Proprietors of the

Wool-Packed Spiral.

Hebbard.

HEBBARD CAR SPRING!

Offices: No. 4 Dey St., New York, and 19 Wells St., Chicago.

FACTORIES: JERSEY CITY, N. J., and SPRINGFIELD, MASS.

Vose, Dinsmore & Co.,

NATIONAL SPRING WORKS,

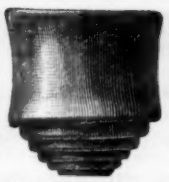
MANUFACTURERS OF

VOLUTE BUFFER, INDIA RUBBER, RUBBER CENTER SPIRAL, COMPOUND SPIRAL, "DINSMORE,"

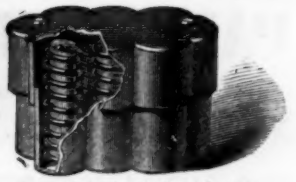
AND OTHER

RAILWAY CAR SPRINGS.

"Dinsmore" Spring.



Volute Buffer Spring.



Group Rubber Center Spiral Spring.

No. 1 Barclay St., NEW YORK. | No. 15 La Salle St., CHICAGO.

WORKS ON 129th AND 130th STREETS, NEW YORK.

GENERAL FREIGHT DEPARTMENT.

The Illinois Central Railroad

ARE PREPARED TO TAKE FREIGHT FOR

Cairo, St. Louis, Peoria,

BLOOMINGTON, SPRINGFIELD, JACKSONVILLE,

And All Points in the Central and Southern parts of the State;

MOBILE & NEW ORLEANS BY RAIL OR RIVER

And ALL POINTS on the MISSISSIPPI below CAIRO. Also, to

Freeport, Galena and Dubuque.

☞ Freight Forwarded with Promptness and Despatch, and Rates at all times as LOW as by any other Route.

BY THE COMPLETION OF THE BRIDGE AT DUNLEITH,

THEY ARE ENABLED TO TAKE FREIGHT TO ALL POINTS WEST OF DUBUQUE ☞ WITHOUT CHANGE OF CARS! ☜

DELIVER FREIGHT IN CHICAGO ONLY at the FREIGHT DEPOT of the Company, foot of South Water St. Parties ordering Goods from the East should have the packages marked:

"Via Illinois Central Railroad."

For THROUGH BILLS OF LADING, and further information, apply to the LOCAL FREIGHT AGENT at Chicago, or to the undersigned.

M. HUGHITT, Gen. Supt. J. F. TUCKER, Gen. Freight Agt.

MOORE

Steel Elastic Car Wheel Co.

OF NEW JERSEY.

Proprietors of

MOORE'S PATENT

FOR THE MANUFACTURE OF

ELASTIC CAR WHEELS,

FOR PASSENGER AND SLEEPING COACHES.

Noiseless, Safe, Durable and Economical.

Also, Manufacturers of

CAR WHEELS OF EVERY DESCRIPTION.

H. W. MOORE, President.
JAS. K. FROTHINGHAM, Secretary.
F. W. BLOODGOOD, Treasurer.

Works, cor. Green and Wayne Sts., JERSEY CITY, N. J.
P. O. Address—Box 129, Jersey City, N. J.

American Compound Telegraph Wire.

More than 3000 Miles now in Operation,

Demonstrating beyond question its superior working capacity, and great ability to withstand the elements. For RAILROAD LINES, connecting a single wire with a large number of Stations, and for long circuits, this wire is peculiarly adapted; the large conducting capacity secured by the copper, with other advantages, rendering such lines fully serviceable during the heaviest rains.

Having a core of steel, a small number of poles only are required, as compared with iron wire construction, thereby preventing much loss of the current from escape and very materially reducing cost of maintenance OFFICE AMERICAN COMPOUND TELEGRAPH WIRE CO.
234 West 29th Street, New York.

BLISS, TILLOTSON & CO., Western Agents,
247 South Water Street, Chicago.

CHAS. J. PUSEY, P. O. Address—Box 5222. EDW'D H. PARDEE

Pusey & Pardee,

74 BROADWAY, NEW YORK.

American and English Rails,

LOCOMOTIVES AND CARS FISH-PLATES, SPIKES, &c.

—SOLE AGENTS FOR—

Atkins Brothers' Pottsville Rolling Mills, and G. Buchanan & Co., of London.

☞ Special attention given to filling orders for small T and **STREET RAILS,** of every weight and pattern.

OLD RAILS BOUGHT OR RE-ROLLED, AS DESIRED.

J. E. FRENCH. W. S. DODGE. D. W. CROSS.

Winslow Car Roofing Company.

PATENT IRON CAR ROOFS.

Established, 1859.

No. 211 Superior St. CLEVELAND, O.

Over 20,000 Cars covered with this Roof! We claim that these Roofs will keep Cars dry, and will last as long as the Cars they cover without any extra expense after once put on.

☞ SEND FOR CIRCULARS.

THE

"RED LINE!"

—RUNNING OVER THE—

Michigan Southern and Lake Shore R. R.'s,

—WAS THE—

FIRST LINE to CARRY FREIGHT BETWEEN the EAST and WEST,

WITHOUT CHANGE OF CARS!

CARS RUN THROUGH TO

NEW YORK AND BOSTON,

IN FOUR AND FIVE DAYS!

☞ Contracts made at the Offices of the Line. ☜

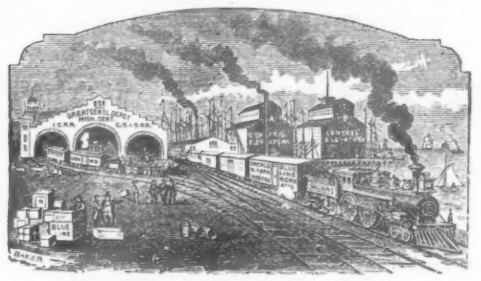
C. Shutter, Agent, 247 Broadway, New York. A. Cushman, Agent, Old State House, Boston, Mass

W. D. MANCHESTER, Agent, 54 Clark St., Chicago.

Great Central Route.

"BLUE LINE."

ORGANIZED JANUARY 1, 1867.

1870.  1870.

OWNED AND OPERATED BY THE

Michigan Central, Illinois Central, Chicago, Burlington & Quincy, Chicago & Alton, Great Western (of Canada), New York Central, Hudson River, Boston & Albany, and Providence and Worcester Railroads.

THE "BLUE LINE" is the only route that offers to shippers of freight the advantages of an unbroken gauge through from Chicago to the Seaboard, and to all Interior Points on the line of Eastern Connections beyond Suspension Bridge and Buffalo. All Through Freight is then transported between the most distant points of the roads in interest.

WITHOUT CHANGE OF CARS!

The immense freight equipment of all the roads in interest is employed, as occasion requires, for the through service of this Line, and has of late been largely increased. This Line is now prepared to extend facilities for the transit and delivery of all kinds of freight in Quicker Time and in Better Order than ever before.

The Blue Line Cars

are all of a solid, uniform build, thus largely lessening the chances of delay from the use of cars of a mixed construction, and the consequent difficulty of repairs, while remote from their own roads. The Blue Line is operated by the railroad companies who own it, without the intervention of intermediate parties between the Roads or Line and the public.

Trains run through with regularity **IN FOUR OR FIVE DAYS** to and from New York and Boston. Especial care given to the Safe and Quick Transport of Property Liable to Breakage or Injury, and to all **Perishable Freight.**

Claims for overcharges, loss or damage, promptly settled upon their merits. Be particular and direct all shipments to be marked and consigned *via*

"BLUE LINE."

☞ *FREIGHT CONTRACTS* given at the offices of the company in Chicago, New York and Boston.

J. D. HAYES, GEN. MANAGER,.. Detroit.

C. E. NOBLE,..... } 349 Broadway, N. Y. | P. K. RANDALL, 69 Washington St., Boston.
GEO. E. JARVIS,... } | W. W. STREET,.....91 Lake St., Chicago.
N. D. MUNSON,.....Quincy, Ill. | J. JOHNSON,.....Cairo, Ill.

THOS. HOOPS, GEN. FR'T AGT. Michigan Central Railroad, Chicago.
A. WALLINGFORD, AGT. M. C. & G. W. R. R., No. 91 Lake St., Chicago.
N. A. SKINNER, Freight Agent Michigan Central Railroad.

Empire Line.

THE EMPIRE TRANSPORTATION COMPANY'S

Fast Freight Line to the East

—AND—

TO THE COAL AND OIL REGIONS,

Via Michigan Southern, Lake Shore, and Philadelphia & Erie R. R.'s,

WITHOUT TRANSFER!

Office, No. 72 LaSalle Street, Chicago.

GEO. W. RISTINE, Western Superintendent, Cleveland, Ohio.

W. G. Van Demark, 265 Broadway, New York. | E. L. O'Donnell,.....Baltimore, Md.
G. B. McCulloh,....43 South 5th St., Philadelphia. | Wm. F. Smith,.....Erie, Penn.

JOHN WHITTAKER, Pier 14 North River, New York.

JOSEPH STOCKTON, Agent, Chicago.

W. T. HANCOCK, Contracting Agent.
WM. F. GRIFFITTS, Jr., Gen. Freight Agent, Philadelphia.

CHICAGO & NORTHWESTERN R. W.

Comprising the PRINCIPAL RAILROADS from CHICAGO Directly NORTH NORTH-WEST and WEST.

ALL RAIL TO THE PACIFIC OCEAN!

Great California Line.

TRAINS LEAVE WELLS STREET DEPOT AS FOLLOWS:

8:30 A. M. Cedar Rapids Pass | **10:15 P. M. Night Mail.**
10:45 A. M. Pacific Express. | **10:15 P. M. Rock Island Pass.**
10:45 A. M. Rock Island Exp. | **4:00 P. M. Dixon Passenger.**

For Sterling, Rock Island, Fulton, Clinton, Cedar Rapids, Boone, Denison, Missouri Valley Junction, Sioux City, Council Bluffs and Omaha, there connecting with the

UNION PACIFIC R. R.

For Cheyenne, Denver, Ogden, Salt Lake, the White Pine Silver Mines, Sacramento, San Francisco, and all parts of Nebraska, Colorado, New Mexico, Arizona, Wyoming, Montana, Idaho, Utah, Nevada, and the PACIFIC COAST.

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
To OMAHA,.....	23	$20.00	To SACRAMENTO,.	4½	$118.00
" DENVER,.....	52	70.75	" SAN FRANCISCO, 5		118.00

TRAINS ARRIVE:—Night Mail, 7.00 a. m.; Dixon Passenger, 11.10 a. m.; Pacific Express 4:15 p. m.; Rock Island Express, 4:15 p. m.; Cedar Rapids Passenger, 6:45 p. m.

FREEPORT LINE.

9.00 A. M. & 9.45 P. M. For Belvidere, Rockford, Freeport, Galena, Dunleith, and St. Paul.

4.00 P. M., Rockford Accommodation.
5.30 P. M., Geneva and Elgin Accommodation
6.10 P. M., Lombard Accommodation.
5:50 P. M., Junction Passenger.

TRAINS ARRIVE:—Freeport Passenger, 2:30 a. m., 3:00 p. m.; Rockford Accommodation, 11:10 a. m.; Geneva and Elgin Accommodation, 8:45 a. m.; Junction Passenger, 8:10 a. m.; Lombard Accommodation, 6:50 a. m.

WISCONSIN DIVISION.

☞ Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows:

10.00 A. M. DAY EXPRESS, for Janesville, Monroe, Whitewater, Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, and Green Bay.

3.00 P. M., Janesville Accommodation.

6.00 P. M. NIGHT EXPRESS, for Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Menasha, Appleton, Green Bay, and THE LAKE SUPERIOR COUNTRY.

5.00 P. M., Woodstock Accommodation.
6:20 P. M., Barrington Passenger.

TRAINS ARRIVE:—5:30 a. m., 7:45 a. m., 1:10 a. m., 1:00 p. m. and 7:15 p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL,.....	8:15 A. M.
EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee,.....9:45 A. M.	5:00 P. M.
EVANSTON PASSENGER,.....	1:00 P. M.
HIGHLAND PARK PASSENGER,.....	1:15 P. M.
MILWAUKEE ACCOMMODATION, with Sleeping Car attached.....	11:00 P. M.
EVANSTON ACCOMMODATION, (Daily,) from Wisconsin Div. Depot.....	6:15 P. M.
KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot.....	4:10 P. M.
AFTERNOON PASSENGER, from Milwaukee Div. Depot.....	5:45 P. M.
WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot.....	5:25 P. M.
WAUKEGAN PASSENGER, (Sundays excepted) from Wells St. Depot.....	5:00 P. M.

TRAINS ARRIVE:—Night Accommodation, with Sleeping Car, 5:00 a. m.; Day Express, 4:10 p. m. Milwaukee Mail, 10:10 a. m.; Afternoon Passenger, 8:00 p. m.; Waukegan Accommodation, 8:25 a. m.; Kenosha Accommodation, 9:10 a.m.; Evanston Accommodations, 1.40 and 4.00 p. m.; Waukegan Passenger, 7:55 a. m.; Highland Park Passenger, 3.45 p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.

THROUGH TICKETS Can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD, Gen. Ticket Agt. — **GEO. L. DUNLAP,** Gen'l Supt.

Milwaukee & St. Paul R. W.

THE ONLY ALL RAIL LINE TO

ST. PAUL AND MINNEAPOLIS!

AND ALL PORTIONS OF

Wisconsin, Minnesota & Northern Iowa.

PURCHASE TICKETS VIA MILWAUKEE.

Passengers Going via Milwaukee,

Have Choice of Seats in Clean Coaches, and on Night Trains, a full night's rest in Palace Sleeping Cars.

☞ BAGGAGE CHECKED THROUGH BY THIS ROUTE ONLY! ☜

PASSENGERS FROM CHICAGO can obtain these Advantages only by the MILWAUKEE DIVISION of the CHICAGO & NORTHWESTERN R'Y.

SPECIAL NOTICE.—Passengers destined to any place in Wisconsin, Minnesota, or Northern Iowa, either on or off the Lines of this Company, who cannot procure Through Tickets to their destination, should purchase their Tickets **TO MILWAUKEE**, as this is the Great Distributing Point for these States.

A. V. H. CARPENTER, Gen. Pass. Agt. Milwaukee. — **S. S. MERRILL,** Gen. Manager, Milwaukee.

CHICAGO, ROCK ISLAND & PACIFIC RAILROAD.

☞ THE DIRECT ROUTE FOR ☜

JOLIET, MORRIS, OTTAWA, LASALLE, PERU, HENRY, PEORIA,
Lacon, Geneseo, Moline,

ROCK ISLAND, DAVENPORT,

Muscatine, Washington, Iowa City,
GRINNELL, NEWTON, DES MOINES,

COUNCIL BLUFFS & OMAHA!

CONNECTING WITH TRAINS ON THE UNION PACIFIC RAILROAD, FOR

Cheyenne, Denver, Central City, Ogden, Salt Lake, White Pine, Helena, Sacramento, San Francisco,

And Points in Upper and Lower California; and with Ocean Steamers at San Francisco, for all Points in **China, Japan, Sandwich Islands, Oregon and Alaska.**

☞ TRAINS LEAVE their Splendid new Depot, on VanBuren Street, Chicago, as follows:

	LEAVE.	ARRIVE
PACIFIC EXPRESS, (Sunday excepted)..	10.00 a. m.	4.15 p. m.
PERU ACCOMMODATION, (Sundays excepted).....	4.30 p. m.	9.45 a. m.
PACIFIC EXPRESS, (Saturdays excepted,).....	10.00 p. m.	[Mon. ex. 7.00 a. m.

ELEGANT PALACE SLEEPING COACHES!

Run Through to Peoria and Council Bluffs, Without Change.

☞ Connections at LA SALLE, with Illinois Central Railroad, North and South; at PEORIA, with Peoria, Pekin & Jacksonville Railroad, for Pekin, Virginia, &c.; at PORT BYRON JUNCTION, for Hampton, LeClaire, and Port Byron; at ROCK ISLAND, with Packets North and South on the Mississippi River.

☞ **For Through Tickets,** and all desired information in regard to Rates, Routes, etc., call at the Company's Offices, No. 37 South Clark Street, Chicago, or 257 Broadway, New York.

A. M. SMITH, Gen. Pass. Agent. — HUGH RIDDLE, Gen. Supt. — P. A. HALL, Asst. Gen. Supt.

KANSAS PACIFIC RAILWAY.

Great Smoky Hill Route,

Now Completed and Open for Business Through to

DENVER, COLORADO.

There Connecting with the DENVER PACIFIC RAILROAD for CHEYENNE, forming, in Connection with the UNION and CENTRAL PACIFIC RAILROADS, another ALL-RAIL ROUTE to

CALIFORNIA, NEVADA, UTAH, MONTANA,

WYOMING, COLORADO, &C.

The most available Passenger and Freight Route to Lawrence, Topeka, Junction City, Abilene, Salina, Hays, KIT CARSON, River Bend, DENVER, CHEYENNE, OGDEN, SALT LAKE CITY,

Sacramento, and San Francisco.

☞ Close Connections are made in Union Depots at KANSAS CITY and STATE LINE with Express Trains of the HANNIBAL & ST. JOSEPH, NORTH MISSOURI and MISSOURI PACIFIC RAILROADS.

Southern Overland Passenger and Mail Coaches leave Kit Carson daily for Pueblo, Trinidad, Fort Union, Santa Fe, &c.

Hughes & Co.'s Splendid Concord Coaches leave Denver daily for Central City, Georgetown, &c.

Passenger and Freight Rates always as low and conveniences as ample as by any other Route.

PULLMAN'S PALACE CARS ACCOMPANY NIGHT EXPRESS TRAINS.

Through Tickets can be obtained at all principal ticket offices. Be careful to ask for tickets via Kansas Pacific Railway, "Smoky Hill Route."

5,000,000 Acres of Farming Lands For Sale!

Situated along the line of this Great National Railway. For particulars, address JNO. P. DEVEREUX. Land Commissioner, Lawrence, Kansas.

R. B. GEMMELL, Gen. Freight & Ticket Agt. — **A. ANDERSON,** Gen. Supt.

THE ERIE & PACIFIC DISPATCH CO.

Are Authorized Freight Agents.

For information, Contracts, and Bills of Lading, apply at their office, 64 Clark Street, Chicago.

H. H. RAPP, AGT.

Western Union Railroad.

CHICAGO & NORTHWESTERN DEPOT, CHICAGO. | MILWAUKEE & CHICAGO DEPOT, MILWAUKEE.

THE DIRECT ROUTE!

CHICAGO, RACINE & MILWAUKEE,

— TO —

Beloit, Savanna, Clinton, Pt. Byron, Davenport, Mineral Point, Madison, Freeport, Fulton, Lyons, Rock Island, Sabula, Galena, Dubuque, Des Moines, Council Bluffs,

OMAHA, SAN FRANCISCO

AND ALL PRINCIPAL POINTS IN

Southern and Central Wisconsin, Northern Illinois, and Central and Northern Iowa.

FRED. WILD, Gen. Ticket Agent. — **D. A. OLIN,** Gen. Superintendent.

THE FAVORITE THROUGH PASSENGER ROUTE!

Chicago, Burlington & Quincy
RAILROAD LINE.

3 THROUGH EXPRESS TRAINS DAILY!

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
TO OMAHA, - - -	23	$20.00	TO DENVER, - -	2½	$63.00
" ST. JOSEPH, - -	21	19.50	" SACRAMENTO, -	4½	118.00
" KANSAS CITY, -	22	20.00	" SAN FRANCISCO,	5	118.00

TRAINS LEAVE CHICAGO from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE

7:40 A. M. **MAIL AND EXPRESS,** (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. **PACIFIC FAST LINE,** (Except Sunday,) stopping at Riverside, Hinsdale, Aurora, Leland, Mendota, Princeton, Buda, Kewanee, Galva, Galesburg, and all stations West and South of Galesburg.
☞ ELEGANT DAY COACHES and **PULLMAN PALACE DRAWING ROOM CARS** are attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

9.00 P. M. **PACIFIC NIGHT EXPRESS,** (Daily, except Saturday,) for Burlington, Ottumwa, DesMoines, Nebraska City, Council Bluffs, Omaha, and all points West. **Pullman Drawing Room Sleeping Car** attached to this Train daily from **Chicago to Burlington,** and Elegant Day Coaches, from **Chicago to Council Bluffs and Omaha, without change!** This is the Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,

—RUNNING THE CELEBRATED—

Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,

And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENW'TH & KANSAS CITY LINE.

7.40 A. M. **MAIL AND EXPRESS** (Except Sunday,) stopping at all stations between Chicago and Galesburg; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Dunleith, Dubuque, La Salle, El Paso, Bloomington, &c.

10:45 A. M. **PACIFIC EXPRESS,** (Daily, except Sunday,) with ELEGANT DAY COACHES and PULLMAN'S PALACE SLEEPING CARS attached, running through from Chicago to KANSAS CITY, **Without Change!**

9:00 P. M. **PACIFIC NIGHT EXPRESS,** (Daily,) with **Pullman Palace Drawing Room Sleeping Car** attached running through from Chicago to QUINCY,

Kansas City, Lawrence, Topeka and Denver,

☞ **WITHOUT CHANGE!** ☜

64 MILES THE SHORTEST AND ONLY ROUTE BETWEEN

Chicago and Kansas City!

WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

Atchison, Weston, Leavenworth, Lawrence,

AND ALL POINTS ON THE KANSAS PACIFIC R'Y.

Local Trains Leave

RIVERSIDE & HINSDALE ACCOMMODATION.7:00 A. M. 1:30 & 6:15 P.M
GALESBURG PASSENGER.....3:00 P. M.
MENDOTA PASSENGER.....4:15 P. M.
AURORA PASSENGER.....5:30 P. M.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, at Company's office, 63 Clark Street, and at Great Central Depot, Chicago at as low rates as by any other route.

ROB'T HARRIS, Gen'l Superintendent, CHICAGO.
SAM'L POWELL, Gen'l Ticket Agent, CHICAGO.
E. A. PARKER, Gen. West. Pass. Agt., CHICAGO.

THE GREAT THROUGH PASSENGER ROUTE TO KANSAS

IS VIA THE OLD RELIABLE

HANNIBAL & ST. JOSEPH
SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

64 MILES THE SHORTEST!

To Kansas City, Fort Scott, Lawrence, Ottawa,

Garnett, Iola, Humboldt, Topeka, Burlingame, Emporia, Manhattan, Fort Riley, Junction City, Salina, Ellsworth, Hays, Sheridan, Olathe, Paola, Cherokee Neutral Lands, Baxter Springs, Santa Fe, New Mexico, and all Points on the KANSAS PACIFIC, and MISSOURI RIVER, FT. SCOTT & GULF R. R's, with which we connect at Kansas City Union Depot.

THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

Missouri, Kansas, Indian Territory, or New Mexico.

DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

THIS is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage Checked Through, and Omnibus Transfers and Ferriage avoided.

P. B. GROAT, Gen. Ticket Agent. HANNIBAL, Mo
GEO. H. NETTLETON, Gen. Supt. HANNIBAL, Mo.

Old, Reliable, Air-Line Route!

CHICAGO, ALTON & ST. LOUIS R. R.

SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO

Bloomington, Springfield, Jacksonville, Alton

— AND —

ST. LOUIS!

WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS WITH MORNING AND EVENING TRAINS

—FOR—

ATCHISON, LEAVENWORTH, KANSAS CITY.

Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

☞ TRAINS leave CHICAGO from the West-side Union Depot, near Madison Street Bridge. ☜

	Depart.	Arrive.
EXPRESS MAIL	*9:15 A. M.	*8:05 P. M.
JOLIET ACCOMMODATION	*4:00 P. M.	*9:40 A. M.
NIGHT EXPRESS	†5:30 "	*12:50 P. M.
LIGHTNING EXPRESS	‡9:00 "	*7:30 A. M.

*Sundays excepted.
†Daily; Saturdays it runs to Bloomington only.
‡Saturdays and Sundays excepted. Monday mornings this train runs from Bloomington to St. Louis.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

BAGGAGE CHECKED THROUGH.

Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

A. NEWMAN, Gen. Pass. Agent. **J. C. McMULLIN, Gen. Supt.**

North Missouri R. R.

PASSENGERS FOR

KANSAS AND THE WEST,

ARE REMINDED THAT

THE NORTH MISSOURI R. R.

—IS—

11 MILES SHORTER than any other Route!

BETWEEN

St. Louis and Kansas City.

15 Miles Shorter between ST. LOUIS and LEAVENWORTH

— AND —

49 MILES SHORTER TO ST. JOSEPH!

THAN ANY OTHER LINE OUT OF ST. LOUIS.

☞ **Three Through Express Trains Daily!** ☜

Pullman's Celebrated Palace Sleeping Cars on all Night Trains!

☞ **FOR TICKETS,** apply at all Railroad Ticket Offices, and see that you get your Tickets via St. Louis and North Missouri Railroad.

C. N. PRATT, Gen. Eastern Agt., 111 Dearborn-st. CHICAGO.
S. H. KNIGHT, Gen. Superintendent, ST. LOUIS.

JAS. CHARLTON, Gen. Pass. and Ticket Agt., St. Louis.

Pacific Railroad of Missouri.

THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,

☞ WITHOUT CHANGE OF CARS! ☜

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R'ys, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

☞ At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Osceola, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.

Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canadas. **Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.**

W. B. HALE, Gen. Pass. and Ticket Agt.
THOS. McKISSOCK, General Superintendent

61 Miles the Shortest Line!

— FROM —

CHICAGO TO NEW YORK.

Pitts., Ft. Wayne & Chicago

— AND —

PENNSYLVANIA CENTRAL

IS THE ONLY ROUTE

Running its Entire Trains **THROUGH** to Philadelphia and New York, and the only Route running Three Daily Lines of Pullman Day and Sleeping Palaces, from Chicago to

PITTSBURGH, HARRISBURG,

PHILADELPHIA & NEW YORK,

☞ WITHOUT CHANGE! ☜

WITH BUT ONE CHANGE TO

BALTIMORE, PROVIDENCE, NEW HAVEN, HARTFORD, SPRINGFIELD, WORCESTER & BOSTON!

AND THE MOST DIRECT ROUTE TO WASHINGTON.

☞ Trains Leave WEST SIDE UNION DEPOT, corner West Madison and Canal Streets, as follows:

		Mail.	Fast Express.	Pacific Exp.	Night Exp.
Leave	CHICAGO	5.30 A. M.	9.00 A. M.	5.15 P. M.	9.00 P. M.
Arrive	PLYMOUTH	9.50 "	12.03 P. M.	8.45 "	12.35 A. M.
"	FORT WAYNE	12.30 P. M.	2.05 "	11.15 "	3.10 "
"	LIMA	3.24 "	4.06 "	1.23 A. M.	5.40 "
"	FOREST	4.43 "	5.08 "	2.45 "	7.07 "
"	CRESTLINE	6.20 "	6.30 "	4.20 "	8.55 "
Leave	CRESTLINE	6.00 A. M.	6.50 "	4.30 "	9.35 "
Arrive	MANSFIELD	6.40 "	7.17 "	5.00 "	10.05 "
"	ORRVILLE	9.15 "	9.05 "	6.54 "	11.55 "
"	ALLIANCE	11.10 "	10.40 "	8.30 "	1.30 P. M.
"	PITTSBURGH	3.45 P. M.	1.55 A. M.	12.10 P. M.	4.40 "
"	CRESSON	11.57 "	5.44 "	4.48 "	10.00 "
"	ALTOONA	12.48 A. M.	6.55 "	5.55 "	2.40 A. M.
"	HARRISBURG	5.30 "	11.25 "	10.45 "	2.50 "
"	PHILADELPHIA	6.50 "	3.15 "	3.00 "	6.50 "
"	NEW YORK, VIA PHILADELPHIA	10.30 "	6.30 "	6.41 "	10.30 "
"	NEW YORK, VIA ALLENTOWN	10.30 "	6.30 "	.....	10.30 "
"	BALTIMORE	9.15 P. M.	3.05 "	2.30 A. M.	9.15 P. M.
"	WASHINGTON	1.00 "	5.15 "	5.45 "	1.00 "
"	BOSTON	9.00 "	5.50 A. M.	6.00 "	9.00 "

Boston and New England Passengers will find this Route especially Desirable, as it gives them an opportunity of Seeing the FINEST VIEWS AMONG THE ALLEGHANY MOUNTAINS,

Besides Visiting PITTSBURGH, PHILADELPHIA and NEW YORK, without extra cost!

☞ All New England Passengers holding Through Tickets will be Transferred, with their Baggage, to Rail and Boat Connections in NEW YORK, **Without Charge!**

THROUGH TICKETS for sale at the Company's Offices, at 65 Clark St.; 52 Clark St.; cor. Randolph and LaSalle Sts.; and at Depot, Chicago. Also at Principal Ticket Offices in the West.

CLOSE CONNECTIONS Made at LIMA for all Points on the Dayton & Michigan and the Cincinnati, Hamilton & Dayton Railways, and at CRESTLINE for Cleveland and Columbus.

Express Trains are Equipped with WESTINGHOUSE AIR BRAKES,

The Most Perfect Protection Against Accidents in the World!

F. R. MYERS, Gen. Pass. & Tkt Agt. P. F.W. & C. R'y Chicago.

W. C. CLELAND, Gen. Western Pass. Agt. P. F. W. & C. R'y, Chicago.

T. L. KIMBALL, Gen. Western Pass. Agt. Penn. Cen. R. R. Chicago.

Broad Gauge! Double Track!

ERIE RAILWAY.

4 EXPRESS TRAINS DAILY!

From Cleveland, Dunkirk and Buffalo, 625 Miles, to New York, WITHOUT CHANGE of Coaches!

☞ The Trains of this Railway are run in DIRECT CONNECTION WITH ALL WESTERN AND SOUTHERN LINES, for

Elmira, Williamsport, Oswego, Great Bend, Scranton, Newburgh,

NEW YORK, ALBANY, BOSTON, PROVIDENCE,

AND PRINCIPAL NEW ENGLAND CITIES.

New and Improved DRAWING ROOM COACHES are attached to the DAY EXPRESS Running THROUGH TO NEW YORK.

☞ **SLEEPING COACHES, Combining all Modern Improvements,** with perfect Ventilation and the peculiar arrangements for the comfort of Passengers incident to the **BROAD GAUGE,** accompany all night trains to New York.

CONNECTIONS CERTAIN! as Trains on this Railway will, when necessary, **wait from one to two hours for Western trains.**

All Trains of Saturday run directly Through to New York.

☞ **Ask for Tickets via Erie Railway,** which can be procured at **66 Clark Street,** Chicago, and at all Principal Ticket offices in the West and Southwest.

L. D. RUCKER, Gen'l Superintendent, New York.

A. J. DAY, Western Passenger Agent, Chicago.

WM. R. BARR, Gen'l Passenger Agent, New York.

Pan-Handle

— AND —

Penn'a Central Route East!

☞ SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO ☜

PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Sunday, NOVEMBER 20th, 1870, Trains for the East will run as follows:

[DEPOT CORNER CANAL AND KINZIE STS., WEST SIDE.]

7:40 A. M. DAY EXPRESS. [SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS	3:00 A. M.	HARRISBURG	10:35 P. M.	NEW YORK	6:40 A. M.
PITTSBURGH	12:15 M.	PHILADELPHIA	3:10 A. M.	BALTIMORE	2:30 A. M.
WASHINGTON	5:45 A. M.	BOSTON	5:05 P. M.		

7:10 P. M. NIGHT EXPRESS. [SUNDAYS EXCEPTED.] Arriving at:

COLUMBUS	11:15 A. M.	HARRISBURG	5:30 A. M.	NEW YORK	11:40 A. M.
PITTSBURGH	7:25 P. M.	PHILADELPHIA	9.50 A. M.	BALTIMORE	9:30 A. M.
WASHINGTON	1:10 P. M.	BOSTON	11:50 P. M.		

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

35 Miles the Shortest Route to Cincinnati.
18 Miles the Shortest Route to Indianapolis and Louisville.

3 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Hamilton, Wheeling, Parkersburg, Evansville, Dayton, Zanesville, Marietta, Lexington, Terre Haute, Nashville,

ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile Vicksburg, Charleston, Savannah,

AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

7.40 A. M. (Sundays excepted) Arriving at

LOGANSPORT	1:15 P. M.
KOKOMO	2:33 P. M.
CINCINNATI	10:10 P. M.
INDIANAPOLIS	5:00 P. M.
LOUISVILLE	11:30 P. M.

8.05 P. M. (Saturdays excepted.) Arriving at

LOGANSPORT	1:15 A. M.
KOKOMO	2:31 A. M.
CINCINNATI	9:35 A. M.
INDIANAPOLIS	5:40 A. M.
LOUISVILLE	3:30 P. M.

Lansing Accommodation: Leaves 3:40 P. M. Arrives 10:55 A. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

☞ Ask for Tickets **via COLUMBUS** for the East, and **via "The AIR LINE"** for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO,** and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN, Gen. Pass. and Ticket Agent, Columbus.

I. S. HODSDON Northwestern Pass. Agt Chicago.

D. W. CALDWELL Gen Supt. Columbus.

The Great Favorite Route for Missouri, Nebraska and Iowa.

KANSAS CITY, ST. JOSEPH

— AND —

COUNCIL BLUFFS

☞ THROUGH LINE! ☜

3 EXPRESS PASSENGER TRAINS Leave Union Depot Daily, on the arrival of Eastern Southern and Western Trains, crossing the Missouri River on the New Iron Bridge at KANSAS CITY, passing the cities of

LEAVENWORTH, ATCHISON, SAINT JOSEPH,

— AND —

NEBRASKA CITY.

Connecting at COUNCIL BLUFFS with Iowa Lines for all prominent points in Iowa, and making DIRECT CONNECTION at **OMAHA** with the Great **Union Pacific Railroad,** for

CHEYENNE, DENVER, SALT LAKE, SACRAMENTO, SAN FRANCISCO

And the Pacific Coast.

Pullman's Palace Sleeping Cars!

ON ALL NIGHT TRAINS.

☞ Ask for Tickets via the People's Favorite Route, **Kansas City, St. Joseph & Council Bluffs Railroad Line.**

A. L. HOPKINS, Gen. Superintendent ST. JOSEPH, Mo.

A. C. DAWES, Gen. Passenger Agent, ST JOSEPH, Mo.

LAKE SHORE
—AND—
MICHIGAN SOUTHERN R.W.

THE GREAT THROUGH LINE BETWEEN

CHICAGO, BUFFALO & NEW YORK,

WITHOUT CHANGE!

AND THE ONLY RAILWAY

RUNNING PALACE COACHES THROUGH!

—BETWEEN—

CHICAGO & NEW YORK, via BUFFALO

☞ WITHOUT TRANSFER OF PASSENGERS! ☜

All Trains Stop at Twenty-Second Street to Take and Leave Passengers. Baggage Checked at that Station for all Points East.

4 EXPRESS TRAINS DAILY, [Sundays Excepted,] Leave Chicago from the New Depot, on Van Buren St., at the head of La Salle Street, as follow

5:30 A. M. MAIL TRAIN.
VIA OLD ROAD AND AIR LINE. SUNDAYS EXCEPTED.

Leaves 22d Street 7:45 A. M. Stops at all Stations. **Arrives**—Cleveland, 9:35 P. M.

9:00 A. M. SPECIAL NEW YORK EXPRESS,
VIA AIR LINE. SUNDAYS EXCEPTED.

Leaves—Twenty-Second Street, **9:15 A. M. Arrives**—Elkhart, 12:45 P. M.; Cleveland 9:45 P. M.; Buffalo, 4:10 A. M.: New York, 7:00 P. M.; (Chicago Time) Boston, 11:45 P. M.

This Train has PALACE SLEEPING COACH Attached, Running

THROUGH TO ROCHESTER, WITHOUT CHANGE!

IN DIRECT CONNECTION WITH

Wagner's Celebrated Drawing-Room Coaches on N. Y. Central R. R.

Only Thirty-Three Hours, Chicago to New York!

5:15 P. M. ATLANTIC EXPRESS (Daily),
VIA OLD ROAD.

Leaves—Twenty-Second Street **5:30 P. M. Arrives**—Laporte, 8:10 P. M. (Stops 20 minutes for Supper); arrives at Toledo, 3:50 A. M.; Cleveland, 7:25 A. M. (20 minutes for Breakfast); arrives at Buffalo, 1:50 P. M.; Rochester, 5:10 P. M. (20 minutes for Supper); connects with **Sleeping Coach running Through from Rochester to Boston Without Change,** making but **One Change between Chicago and Boston.**

NEW AND ELEGANT SLEEPING COACH Attached to this Train, Running THROUGH from CHICAGO TO NEW YORK WITHOUT CHANGE! Arrives at NEW YORK, 7:15 A. M.

9:00 P M. NIGHT EXPRESS
VIA AIR LINE. (DAILY EXCEPT SAT. & SUN.)

Leaves—Twenty-Second Street, **9:15 P. M. Arrives**—Toledo, 6:15 A. M. (20 minutes for Breakfast); arrives at Cleveland, 10:50 A. M.; Buffalo, 5:50 P. M.; New York, 12:00 M.; Boston, 3:50 P. M.

KALAMAZOO DIVISION.

Leave Chicago 9:00 A. M. Arrive at Kalamazoo 4:10 P. M.; Grand Rapids, 7:10 P. M.

Leave Chicago 9:00 P. M. Arrive at Kalamazoo 7:25 A. M.; Grand Rapids, 10:15 A. M.

☞ There being no heavy grades to overcome, or mountains to cross, the road bed and track being the smoothest and most perfect of any railway in the United States, this Company run their trains at a high rate of speed with perfect safety.

☞ Travelers who wish to SAVE TIME and make SURE CONNECTIONS, purchase Tickets via

LAKE SHORE & MICHIGAN SOUTHERN R'Y.

THE ONLY LINE RUNNING THROUGH BETWEEN CHICAGO AND BUFFALO, WITHOUT TRANSFER, and in Direct Connection with NEW YORK CENTRAL RAILROAD and ERIE RAILWAY.

General Ticket Office for Chicago, No. 56 Clark Street.

CHAS. F. HATCH,
General Superintendent, Cleveland, Ohio

F. E. MORSE,
General Western Passenger Agent, Chicago.

ILLINOIS CENTRAL RAILROAD.

PASSENGER TRAINS LEAVE CHICAGO FROM THE GREAT CENTRAL DEPOT, FOOT OF LAKE ST.

ST. LOUIS AND CHICAGO
THROUGH LINE.

No Change of Cars from Chicago to St. Louis.

9:20 A. M. DAY EXPRESS Sundays Ex.
Arriving in ST. LOUIS at 10:30 P. M.

8:15 P. M. FAST LINE. Saturdays Excepted.
Arriving at ST. LOUIS at 8:00 A. M.

AT ST. LOUIS, Direct Connections are Made FOR

Jefferson City, Sedalia, Pleasant Hill, Macon, Kansas City,

LEAVENWORTH, ST. JOSEPH & ATCHISON,

—Connecting at KANSAS CITY for—

LAWRENCE, TOPEKA, JUNCTION CITY, SALINA, SHERIDAN,

Denver and San Francisco!

CAIRO, MEMPHIS AND NEW ORLEANS LINE.

No Change of Cars from Chicago to Cairo.

9:20 A. M. CAIRO MAIL, Sundays Excepted.
Arriving at **Cairo** 2:05 A. M., **Memphis** 12:45 P. M., **Mobile** 9:25 A. M. **Vicksburg** 9:25 A. M., **New Orleans** 11:05 A. M.

8:15 P. M. CAIRO EXPRESS, Except Saturdays.
Arriving at **Cairo** 12:24 P. M., **Memphis** 4:15 A. M., **Little Rock** 7:00 P. M., **Vicksburg** 8:10 P. M., **New Orleans** 1:30 A. M.

4:50 P. M. CHAMPAIGN PASSENGER,
Arriving at **Champaign** at 10:45 P. M.

☞ THIS IS THE ONLY DIRECT ROUTE TO

Humboldt, Corinth, Grand Junction, Little Rock, Hot Springs, Selma, Canton, Grenada, Columbus, Meridian, Enterprise,

MEMPHIS, VICKSBURG, NEW ORLEANS & MOBILE.

At NEW ORLEANS, connections are made for

GALVESTON, INDIANOLA,

And all Parts of Texas.

☞ **NOTICE.—This Route is from 100 to 150 MILES SHORTER, and from 12 to 24 HOURS QUICKER than any other.**

THIS IS ALSO THE ONLY DIRECT ROUTE TO

DECATUR, TERRE HAUTE, VINCENNES & EVANSVILLE.

Peoria and Keokuk Line.

9:20 A. M. KEOKUK PASSENGER, Sun. Excepted.
Arriving at **Chenoa** 3:20 P. M., **El Paso** 4:08 P. M., **Peoria** 5:43 P. M., **Canton** 7:15 P. M., **Bushnell** 8:57 P. M., **Keokuk** 11:15 P. M., **Warsaw** 11:40 A. M.

Elegant Drawing Room Sleeping Cars

ATTACHED TO ALL NIGHT TRAINS.

Spacious and Fine Saloon Cars!

WITH ALL MODERN IMPROVEMENTS, RUN UPON ALL TRAINS.

BAGGAGE CHECKED THROUGH TO ALL IMPORTANT POINTS.

☞ For Through Tickets, Sleeping Car Berths, Baggage Checks, and information, apply at the office of the Company in the Great Central Depot, foot of Lake St.

Hyde Park and Oakwoods Train.

	LEAVE.	ARRIVE.		LEAVE.	ARRIVE.
HYDE PARK TRAIN,...	*6:30 A. M.	*7.45 A. M.	HYDE PARK TRAIN,....	*2:00 P. M.	*3:15 P. M
HYDE PARK TRAIN....	*8:00 A. M.	*9.20 A. M.	HYDE PARK TRAIN,....	*6:10 P. M.	*7:35 P. M
HYDE PARK TRAIN,..	*12:10 P. M.	*1:45 P. M.			

* Sundays Excepted.

W. P. JOHNSON, Gen. Pass. Agent. M. HUGHITT, Gen. Supt.

1870. Great Central Route! 1870.

SPEED! COMFORT! SAFETY!

MICHIGAN CENTRAL and GREAT WESTERN RAILWAYS!

The Great Central Route, via Niagara Falls, to

NEW YORK AND NEW ENGLAND.

Pullman's Magnificent Palace Drawing-Room Cars,

— FROM —

CHICAGO TO NEW YORK CITY, WITHOUT CHANGE.

4 PASSENGER TRAINS LEAVE CHICAGO, DAILY EXCEPT SUNDAY.
(DEPOT, FOOT OF LAKE STREET,) as Follows:

5:40 A. M. MAIL TRAIN. Stops at all Stations.
(SUNDAYS EXCEPTED.) Arrives DETROIT at 6:30 P. M.

9:00 A. M. SPECIAL NEW YORK & BOSTON EXP.
(SUNDAYS EXCEPTED.) Arrives at Michigan City 11:10 A. M; Niles 12:40, [Dinner], Kalamazoo 2:15 P. M.; Battle Creek 3:00, Marshall 3:24, Jackson 4:30, Detroit 6:55; London 12:05, A. M Hamilton 2:35 A. M.; Toronto 10.00, Suspension Bridge 4:40, Rochester 7:15 A. M.; Albany, 2:25 P. M.; NEW YORK, 7:00, BOSTON, 11:45 P. M. ☞ This train connects at ROCHESTER (7:15 A. M.) with

Wagner's Magnificent Palace Drawing-Room Cars!

☞ RUNNING THROUGH TO NEW YORK, WITHOUT CHANGE! ☜

5:15 P. M. ATLANTIC EXPRESS.
(DAILY.) Arrives at Michigan City, 7:22 P. M.; Niles 8:57 P. M. [Supper]; Kalamazoo, 10:20 P. M.; Jackson, 1:05 A. M.; Detroit 3:45, London, 8:35, [Breakfast]; Hamilton 11:40, Suspension Bridge 2:35 P. M.; Rochester 5:10 P. M.; Albany, 1:50 A. M.; NEW YORK, 7:15 A. M.; BOSTON, 11:00 A. M.
A MAGNIFICENT DRAWING-ROOM SLEEPING CAR is attached to this train daily, FROM CHICAGO TO NEW YORK CITY. The celebrated

☞ **Hotel Drawing-Room Car is also attached to this Train from Chicago to Rochester!** ☜

☞ These, together with **ELEGANT DAY CARS TO SUSPENSION BRIDGE,** make this Train the favorite Train for all points East.

SPECIAL NOTICE.—Boston and New England Passengers will please notice that this Train now makes direct connection through. A SLEEPING CAR is attached at Rochester at 5.20 P. M., running through to Springfield, Mass., thus avoiding transfer at Albany. Breakfast at Springfield. This Train reaches Springfield early enough second morning to **Connect with all Trains** up and down the Connecticut.

9:00 P. M. NIGHT EXPRESS.
(SAT. & SUN. EXCEPTED). Arrives at Michigan City, 11:10 P. M.; Niles, 12:28 A. M.; Kalamazoo, 2:10; Marshall, 3:25; Jackson, 4:45; Grand Trunk Junction, 7:30; Detroit, 7:45; London, 1:45 P. M.; Hamilton, 4:35; Toronto, 9:35; Niagara Falls, 6:25; Buffalo, 7:15 P. M.; Rochester, 9:05; Syracuse, 12:25 A. M.; Rome, 1:55; Utica, 2:25; Albany, 6:30 A. M.; NEW YORK, **12:00 M.**; BOSTON, **3:50 P. M.**

PULLMAN'S PALACE SLEEPING CARS ARE ATTACHED TO THIS TRAIN FROM CHICAGO TO DETROIT,
And from Suspension Bridge to New York.

WE INVITE THE ATTENTION OF THE TRAVELER to the SPLENDID EQUIPMENTS of this FIRST-CLASS LINE TO THE EAST!

☞ FOR THROUGH TICKETS, and any and all information, Sleeping Car accommodations, &c., apply at General Office in Tremont House Block, at office in Great Central Depot; also at No. 60 Clark street, under Sherman House; at Grand Trunk Railway Office, 48 Clark street, or at New York Central Railroad Office, No. 53 Clark street, and at office under Briggs House.

H. E. SARGENT, Gen. Supt. M. C. R. R. W. K. MUIR, Gen. Supt. Gt. Western R. W. HENRY C. WENTWORTH, Gen. Pass. Agt.

CHICAGO, INDIANAPOLIS & LOUISVILLE

THROUGH LINE!

—VIA—

MICHIGAN CENTRAL RAILROAD.

THE ONLY ROUTE TO

TO LOUISVILLE, WITHOUT CHANGE OF CARS.

TWO EXPRESS TRAINS Leave Chicago Depot, Foot of Lake as Follows:

9:00 A. M. MORNING EXPRESS
(EXCEPT SUNDAY.) Arriving at LaFayette, 2:25 P. M.; Indianapolis, 6:00 P. M; Louisville, 11:30 P. M.

4:30 P. M. AFTERNOON EXPRESS
(EXCEPT SATURDAY) Arriving at Michigan City 6:20 P. M. [Supper]; LaFayette, 11:30 P. M. Indianapolis, 3:15 A. M.; Louisville, 7:00 A. M.; Nashville, 4 00 P. M.

A GOOD SLEEPING CAR is Attached to this Train Every Night,
And goes from Chicago to Louisville WITHOUT CHANGE!

☞ **SPECIAL NOTICE.**—This Train stops at Michigan City for Supper, and waits at that point for Michigan Central Atlantic Express East, leaving Chicago at 4:45 p. m. Passengers going South, and wishing as much time in Chicago as possible, can take the 4:45 p. m. Michigan Central Atlantic Express, and connect without fail at Michigan City, with above Through Louisville Express.

☞ **THE GREAT BRIDGE ACROSS THE OHIO** at Louisville being completed, passengers are relieved of the omnibus transfer.

FOR THROUGH TICKETS, via this line, apply at offices of connecting lines and at all Ticket offices in Chicago.

HENRY C. WENTWORTH, Gen. Pass. Agent.

Michigan Central R. R.

LOCAL CONNECTIONS:

Chicago & Michigan Lake Shore Railroad.
Open from New Buffalo to St. Joseph, Mich.
5:00 A. M. AND 4:30 P. M. Trains from Chicago Connect at New Buffalo.

Kalamazoo, Allegan & Grand Rapids R. R.
Open to Grand Rapids.
11:30 A. M. AND 9:00 P. M. Trains from Chicago Connect at Kalamazoo

Peninsular Railroad of Michigan.
Open to Charlotte.
5:00 A. M. AND 9:00 P. M. Trains from Chicago Connect at Battle Creek.

Jackson, Lansing & Saginaw Railroad.
Open to Bay City, Mich. Passing through Lansing and Saginaw.
5:00 A. M. AND 9:00 P. M. Trains from Chicago Connect at Jackson.

GRAND TRUNK RAILWAY.

All Michigan Central Trains Connect at Grand Trunk Junction

— FOR —

SARNIA, TORONTO, MONTREAL,

PORTLAND, BOSTON, BUFFALO, OGDENSBURG

AND ALL POINTS EAST.

H. E. SARGENT, General Superintendent.

JACOB R. SHIPHERD & CO.,

155 and 157 LaSalle Street,

CHICAGO.

RAILWAY BANKERS

NEGOTIATE

MORTGAGE BONDS,

And Local Bonds issued in Aid;

Make Advances; Complete Unfinished Roads, etc., etc.

BLISS, TILLOTSON & CO.,

Manufacturers and Dealers in

TELEGRAPH MACHINERY,

— AND —

SUPPLIES

Of Every Description.

247 South Water Street,

CHICAGO, ILL.

L. G. TILLOTSON & CO., N. Y. | G. M. BLISS, CHICAGO.

Established 1852.

CLEVELAND FILE WORKS

CLEVELAND, OHIO.

All descriptions of Files Manufactured and Recut. Also, dealers in *Best English Cast Tool Steel*. Orders solicited and satisfaction guaranteed. JOHN PARKIN, Prop'r.

GIRARD

TUBE WORKS & IRON COMPANY.

PHILADELPHIA, PA.

Manufacture Plain and Galvanized WROUGHT IRON PIPE and Sundries for Gas and Steam Fitters, Plumbers, Machinists, Railing Makers, Oil Refiners, &c.

WORKS—Twenty-Third and Filbert Streets.
OFFICE AND WAREHOUSE—No. 42 N. Fifth St.

NEWS DEALERS

Should Address Orders for

THE RAILROAD GAZETTE,

— TO —

The Western News Company,

CHICAGO.

IMPORTANT DISCOVERY!

"A COPYING PRINTERS' INK,"

[McILVAINE'S PATENT.]

Peculiarly adapted for

Manifests, Bills of Lading, Bank Circulars, Reports and Statements of Accounts Current, Letter Heads, &c.

Yielding as PERFECT AN IMPRESSION as that of the BEST COPYING INK for writing purposes—the use of the two in connection filling a want never heretofore supplied.

HELFENSTEIN & LEWIS,

Railroad and Commercial Printing Rooms.

Corner of Fifth and Chestnut Streets,

PHILADELPHIA.

☞ Specimen Impressions furnished on application.

BENOIT & WOOD,

Manufacturers and Importers of

Artists' Materials!

Drawing Paper, Mathematical Instruments, Architects' and Engineers' Supplies. Patented T Squares, Triangles and Straight Edges.

148 FULTON STREET, NEW YORK.

HARRISBURG

CAR MANUFACTURING CO.,

Harrisburg, Pennsylvania,

MANUFACTURE

Passenger, Mail, Baggage, Box Gondola, Coal,

AND ALL OTHER KINDS OF

RAILROAD CARS!

Railroad Car Wheels & Castings, Bridge & Rolling Mill Castings, Bridge Rods, Bolts,

—AND—

RAILROAD FORGINGS!

W. T. HILDRUP, *Superintendent.*
WILLIAM COLDER, *President.*

HARRISBURG

Foundry and Machine Works!

(Branch of Harrisburg Car Mfg Co.,)

Harrisburg, - - Pennsylvania.

MANUFACTURERS OF

MACHINISTS' TOOLS!

— SUCH AS —

LATHES, PLANERS, Shaping and Slotting Machines, Bolt Cutting & Nut Tapping Machines, &c.

W. T. HILDRUP, *Treasurer.*

PHŒNIXVILLE BRIDGE WORKS.

Clarke, Reeves & Co.,

Successors to Kellogg, Clarke & Co.,

Engineers & Iron Bridge Builders,

OF PHŒNIXVILLE, PA.,

Will henceforth have their Principal Business Office at 410 Walnut St., Philadelphia, to which all correspondence should be addressed. Circulars, plans and prices sent on application.

IRON BRIDGES, PIVOT BRIDGES

— AND —

Turn Tables.

F. C. LOWTHORP,

Civil Engineer, Patentee & Builder,

78 E. STATE STREET,

TRENTON, N. J.

F. E. Canda,

BRIDGE BUILDER

—AND—

GENERAL CONTRACTOR.

No. 2 S. Clark St.,

CHICAGO. - - ILLINOIS.

AKRON CEMENT.

Union Akron Cement Company,

SOLE MANUFACTURERS.

OFFICE AND WAREHOUSE:

88 MARKET ST., CHICAGO.

20 Central Wharf, Buffalo.

Orders of Contractors, Railroads, and Bridge Builders, promptly filled.

NOTICES OF THE PRESS.

"Of great interest to railroadmen."—[Delaware (O.) Gazette.

"Valuable because of its reliab[illegible]."—[Holmesburg (Pa.) Gazette.

"A valuable encyclopædia of [illegible]way topics."—[The Stockholder.

"The best journal of the cla[illegible]ublished."—[Philadelphia Herald.

"An excellent journal for railro[illegible]n."—[Mankato (Minn.) Record.

"The best paper of the kind [illegible] extant."—[Official Railway News.

"Promising much for the fut[illegible]—[Detroit Commercial Advertiser.

"A model of what a railroad news[illegible]per should be."—[Chicago Tribune.

"The best journal of its class in the United States."—[LaCrosse Leader.

"We regard it as the best railroad paper out."—[Peoria National Democrat.

"Every railroad man reads the GAZETTE."—Bloomington (Ill.) Leader.

"A complete repository of railroad news."—[Harrisburg (Pa.) Patriot.

"Equal in appearance to any technical journal of America."—[Atchison Patriot.

"The best medium for railroad information published."—[Kankakee (Ill.) Times.

"Replete with matters connected with railroading."—[Holmesburg (Pa.) Gazette.

"Well worthy the patronage of all intelligent railroad men."—[Kalamazoo Gazette.

"A well-edited paper, showing industry and intelligence."—[American Railway Times.

"The best informed railway newspaper published in the West."—[Aurora (Ill.) Beacon.

"Unquestionably the best railroad journal in the United States.—[Waukegan (Ill.) Patriot.

"Standing in the front ranks of railroad journals."—[Snow's Pathfinder Railway Guide.

"Makes a very handsome appearance and is full of valuable matter."—[Chicago Evening Post.

"An impartial and independent journal, valuable to every railroad man."—[Parkersburg (W. Va.) Times.

"Of great interest to railroad men, and almost equally so to those who use railroads."—[Marshall (Mich) Statesman.

"It must prove a very valuable paper to stockholders and those who are interested in railroads."—[New York Globe.

"Every man who is at all interested in railroads would do well to take the GAZETTE"—[Jacksonville (Ill.) Independent.

"All who desire to keep themselves posted on the subjects connected with railroads will take it."—[Milwaukee Wisconsin.

"One of the best conducted and most interesting railway journals published in this country."—[New Haven Railway Courant.

"It will compare favorably with any similar publication, not only in New York or Boston, but in London or on the Continent."—[Waukegan (Ill.) Gazette.

THE RAILROAD GAZETTE.

A Weekly Journal of Transportation, Engineering and Railroad News.

Devoted to the Discussion of Subjects Connected with the Business of Transportation, and the Dissemination of Railroad News.

Illustrated Descriptions of Engineering Works and Railroad Machinery and Rolling Stock.

Contributions from Practical Railroad Men, on the Business of Railroading.

A Complete Record of Railroad News.

NEW ORGANIZATIONS. *ENGINEERING AND MECHANICS.*
PROGRESS OF NEW ROADS. *TRAFFIC AND EARNINGS.*
ELECTIONS AND APPOINTMENTS. *LAKE AND RIVER NAVIGATION.*
RAILROAD LAW. *RAILROAD MANUFACTURES.*

The Cream of the American and European Technical Periodicals.

An Impartial and Independent Journal, Valuable to Every Railroad Man.

TERMS OF SUBSCRIPTION:

Single copy, per annum.....$4.00
Three copies, per annum.....11.00
Eight copies, per annum, and one to the person who gets up the club.....$30.00

Subscriptions for One Year or less will be received up to Jan. 1st, at $3.00 a Year.

ADVANCE PAYMENT is required.
CANADA SUBSCRIBERS, twenty-five cents additional.
SINGLE COPIES, ten cents each.
ADVERTISING RATES will be made known on application.

Address— A. N. KELLOGG, Publisher,
101 Washington St., Chicago

"In every respect a worthy representative of the energetic and go-ahead city where it is published."—[Cincinnati Railroad Record.

"We consider it the most complete mirror of our railroad, shipping, monetary and other chief interests to be found in the country."—[Nebraska Register.

"Has always been one of the most valuable publications in the West * * * Is bound to continue its sway as the leading railroad journal of the country.—[Sedalia (Mo.) Bazoo.

"As it devotes much attention to Southern railroad and industrial interests, it is always interesting to Southern readers."—[Galveston News.

"For railroad men and others wishing to keep themselves thoroughly posted on railroad matters we know of no better paper."—[Madison State Journal.

"One of our most valuable exchanges. * * * Its columns teem with reliable information of great benefit to railroad men of every section of the United States."—[Leavenworth Bulletin.

NOTICES OF THE PRESS.

"Has always been one of the best papers of the country for railroad intelligence."—[New York Commercial and Financial Chronicle.

"A most valuable thing to the engineer and all railway men, the capitalist, traveler mechanic and general reader."—[Brooklyn (N. Y.) Argus.

"We know not where its equal can be found. * * * * One of the most valuable journals in the country."—[Evansville (Wis.) Review.

"Full of information, scientific and general, with regard to railroads all over the country, their construction, operation, etc."—[Rochester Chronicle.

"This excellent weekly keeps its readers better posted as to what is going on in the railroad world than any other we have seen."—[Albany (Ga.) News.

"A publication of great value to every one interested in railroads and railroading, and its scientific articles are of great value to every scholar."—[Oshkosh (Wis.) Northwestern.

"In its financial and commercial views in connection with the railroad interests of the country, may be regarded as one of the first papers of the United States."—[Pensacola Observer.

"Emphatically a journal of transportation, and contains every conceivable item of news on the subject of railroads, steamboats, telegraphs, express companies, etc."—[Flint (Mich.) Globe.

"The news is very full, the discussions are conducted in good temper and with excellent information. To judge from this first number, the conductors of the GAZETTE know what "railroading" is, and what a proper weekly journal should be."—[New York World.

"A very neat publication in point of appearance, and, as it always has been, is now a reliable, interesting and accurate journal, ably edited in its various departments. * * * Our scissors have wandered over its columns "many a time and oft," and always with gratifying results."—[Buffalo Commercial Advertiser

"Has been for thirteen years a live, energetic railroad newspaper, and has fought its way up among its many competitors for the favor of the railroad public, gaining in strength and rising in importance year by year, until to-day it stands second to no journal of that important class in the United States."—[Peoria Daily Transcript.

"We have perused each succeeding number with great interest—its comprehensive information of railway matters, its sensible editorials, its able contributions and descriptions of new machines for railway use—and pronounce it by far the most progressive and valuable railway journal published in the United States."—[Pittsburgh Iron World and Manufacturer.

"We are glad of the opportunity of adding our cordial testimony to the great excellence of this periodical, which has certainly taken a first rank in the railroad literature of the modern world. Its writers have both information and experience; its extracts from foreign journals are selections of the best, while its news columns leave little to be desired by those who wish to be kept *au courant* with the location and construction of new lines and changes and improvements in the older organizations."—[United States Railroad and Mining Register.